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ABSTRACT

The general purpose of the occupational analysis is to provide workable, basic information dealing with the many and varied duties performed in the air conditioning, refrigerating, and heating occupation. The document opens with a brief introduction followed by a job description. The bulk of the document is presented in table form. Six duties are broken down into a number of tasks and for each task a two-page table is presented, showing on the first page: tools, equipment, materials, objects acted upon; performance knowledge (related also to decisions, cues and errors); safety--hazard; and on the second page: science; math--number systems; and communications (performance modes, examples, and skills and concepts). The duties include installing, troubleshooting, servicing, and repairing refrigeration and air conditioning equipment and warm air heating systems. Included are lists for a standard tool kit, test equipment, and standard supplies. An appendix relates the duties to air conditioning, refrigeration, and heating. (BP)

Occupational Analysis

CE 004 265

AIR CONDITIONING, REFRIGERATING AND HEATING

Instructional Materials Laboratory
Trade and Industrial Education
The Ohio State University

5049

AN ANALYSIS OF THE AIR CONDITIONING, REFRIGERATING AND HEATING OCCUPATIONS

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The Instructional Materials Laboratory
Trade and Industrial Education
The Ohio State University

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FOREWORD

The occupational analysis project was conducted by The Instructional Materials Laboratory, Trade and Industrial Education, The Ohio State University in conjunction with the State Department of Education, Division of Vocational Education pursuant to a grant from the U.S. Office of Education

The Occupational Analysis project was proposed and conducted to train vocational educators in the techniques of making a comprehensive occupational analysis. Instructors were selected from Agriculture, Business, Distributive, Home Economics and Trade and Industrial Education to gain experience in developing analysis documents for sixth-one different occupations. Representatives from Business, Industry, Medicine, and Education were involved with the vocational instructors in conducting the analysis process.

The project was conducted in three phases. Phase one involved the planning and development of the project strategies. The analysis process was based on sound principles of learning and behavior. Phase two was the identification, selection and orientation of all participants. The training and workshop sessions constituted the third phase. Two-week workshops were held during which teams of vocational instructors conducted an analysis of the occupations in which they had employment experience. The instructors were assisted by both occupational consultants and subject matter specialists.

The project resulted in producing one hundred two trained vocational instructors capable of conducting and assisting in a comprehensive analysis of various occupations. Occupational analysis data were generated for sixty-one occupations. The analysis included a statement of the various tasks performed in each occupation. For each task the following items were identified: tools and equipment; procedural knowledge; safety knowledge; concepts and skills of mathematics, science and communication needed for successful performance in the occupation. The analysis data provided a basis for generating instructional materials, course outlines, student performance objectives, criterion measures as well as identifying specific supporting skills and knowledge in the academic subject areas.

PREFACE

This occupational analysis conducted for the air conditioning, refrigeration, and heating occupations presented the writers with several difficult decisions and alternatives. Each area of the occupations has a separate identity and has functioned in this manner for many years. However, the growth of the refrigeration and air-conditioning industry has brought these identities closer together because many of the duties and tasks performed on the job are interrelated. Many of the skills are common to each area. Therefore, if we are to offer a training program, the entire scope of the air conditioning, refrigeration and heating occupations should be included in the course content. The list of tasks found in the appendix identifies the interrelationships of the tasks performed in each area of the occupations.

There are many job opportunities within the air conditioning, refrigeration and heating fields which specialize in one or several specific areas. Training individuals for entry level into these fields should be conducted to include all the basic skills of the refrigeration, air conditioning and heating occupations. The objective of this occupational analysis is to encompass all the duties and tasks of the technician in these fields. In the time available to complete the analysis, an in depth study was not possible. Therefore, an overview of the air conditioning, refrigeration and heating occupations was more realistic. Hopefully, it will provide some basis for future study.

ACKNOWLEDGMENT

We wish to acknowledge the valuable assistance rendered by the following subject matter specialists. They provided input to the vocational instructors in identifying related skills and concepts of each respective subject matter area and served as training assistants in the analysis process during the two-week workshops.

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JOB DESCRIPTION

An air conditioning, refrigeration and heating technician engages in the installation of air conditioning, refrigeration and heating equipment such as window air conditioners; central air conditioning units; commercial refrigeration equipment; and gas, oil and electric warm air furnaces. A technician also troubleshoots and performs service and repairs on household refrigerators, freezers, dehumidifiers, window air conditioners, central air conditioning units, commercial refrigeration units and warm air heating systems.

Duty I Installing Refrigeration and Air Conditioning Equipment

1 Install window air conditioner
2 Install central air conditioner
3 Install self contained commercial refrigeration unit
4 Install remote condensing unit with single cabinet
5 Install remote commercial condensing unit with multiple cabinets

(TASK STATEMENT) I-1 INSTALL WINDOW AIR CONDITIONER

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

STK
VOM
AP
SS II

PERFORMANCE KNOWLEDGE

Check power supply
Check air conditioner capacity in relation to what customer expects
Install unit in window and seal any openings to outside
Check unit for performance, instruct customer as to proper care, maintenance and operation

SAFETY – HAZARD

Safety:

Do not lift loads from a bending position. Always lift from a squatting position with back straight.
Ground power equipment and use with care.
Care in the use of hand tools

Hazards:

Potential back injury or rupture
Electrical shock-burn or personal injury
Injury to oneself or others

DECISIONS

Determine mounting position frame and/or cabinet centered on the window sill

CUES

Window mounting frame and/or cabinet can be installed in window.

ERRORS

Air conditioner not adaptable to window design resulting in faulty or no installation.

ASK STATEMENT) I-1 INSTALL WINDOW AIR CONDITIONER

SCIENCE

Simple machines used to gain mechanical advantage
[STK]
Forces acting on a body immersed or floating in a liquid
[Level]

Behavioral Science:

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
He should consult with superiors when difficulty arises.
He should answer questions which relates to the repair job at hand with honesty and integrity.
He should maintain a proper balance between pressure to complete job and pride in work.
Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.
He should be cautioned to enter only into those customer relations which pertain to the job at hand. Personal entanglements or arguments with customers should always be avoided.
Billing and discussion of costs should be accurate, honest and performed in a straight forward manner.
He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

MATH — NUMBER SYSTEMS

Rationals—Fractions

Use of Numbers: (without calculation)
[eyeballing floor area]
Ordering—[S.T.K.]
Coding—[mfg. data plate]
Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Arithmetic Skills and Concepts--Rule of thumb
[approximation]
Basic Geometry Skills and Concepts
Knowledge of geometric relationships—Symmetry
[center point]
Determination of area, perimeter and diagonals of polygons with more than 4 sides.
Basic Arithmetic Skills and Concepts—Property of comparison
Basic Measurement Skills and Concepts
Instruments—[tape]
Measurement: Geometric
Linear
Area
Reading and interpreting tables, charts, and graphs—[capacity chart]

COMMUNICATIONS

PERFORMANCE MODES

Reading

Viewing

Speaking

Writing

EXAMPLES

Instructions

Position of mounting frame

Verbal instructions

Service order

SKILLS/CONCEPTS

Process Report

Visual Analysis

Terminology/General Vocabulary
Clarity of Expression

Inform- report
Termir ·y
Clarity ssion

(TASK STATEMENT) I-2 INSTALL CENTRAL AIR CONDITIONER

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

STK
Concrete forms
Mixing pan
SS-II
VOM
AP
MG

PERFORMANCE KNOWLEDGE

Form concrete pad for condensing unit and install
Install cooling coil
Hook up suction and liquid lines from condensing unit to evaporator coil
Install power supply and revamp low voltage circuitry if necessary
Check system and instruct customer

SAFETY – HAZARD

Safety:

Do not lift loads from a standing position. Always lift from a squatting position with back straight.
Ground power equipment before use with care.
Care in the use of hand tools

Hazards:

Potential back injury or rupture
Electrical shock, burn or personal injury
Injury to oneself or others

DECISIONS

Determine location for condensing unit pad.
Determine position of cooling coil in furnace plenum

CUES

Survey premises for adequate power supply and proper size unit

ERRORS

Inadequate utilities or improper size unit resulting in faulty installation

SK STATEMENT) I-2 INSTALL CENTRAL AIR CONDITIONER

SCIENCE

Simple machines used to gain mechanical advantage
[STK]
Forces acting on a body immersed or floating in a liquid
[Level]
Effect of heating and cooling on expansion of materials
Effect of heating and cooling on state of matter
[refrigerant]
Fluids under pressure
[refrigerant under pressure]

Behavioral Science:

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
He should consult with superiors when difficulty arises.
He should answer questions which relates to the repair job at hand with honesty and integrity.
He should maintain a proper balance between pressure to complete job and pride in work.
Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.
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Billing and discussion of costs should be accurate, honest and performed in a straight forward manner.
He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

MATH – NUMBER SYSTEMS

Rationals—Fractions

Use of Numbers: (without calculation)
[evaluating floor area]
Ordering—[S.T.K.]
Coding—[mfg. data plate]
Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Arithmetic Skills and Concepts—Rule of thumb
[approximation]
Basic Geometry Skills and Concepts
Knowledge of geometric relationships—Symmetry
[center point]
Determination of area, perimeter and diagonals of polygons with more than 4 sides.
Basic Arithmetic Skills and Concepts—Property of comparison
Basic Measurement Skills and Concepts
Instruments—[tape]
Measurement: Geometric
Linear
Area
Reading and interpreting tables, charts, and graphs—[capacity chart]

COMMUNICATIONS

PERFORMANCE MODES

Reading

Viewing

Speaking

Writing

EXAMPLES

Instructions

Survey premises

Verbal instructions

Service order

SKILLS/CONCEPTS

Process report

Visual analysis

Terminology/General Vocabulary
Clarity of expression

Informational report
Terminology
Clarity of expression

I-3 INSTALL SELF-CONTAINED COMMERCIAL REFRIGERATION UNIT

(TASK STATEMENT)

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
STK MG	Level equipment and attach manifold and guages Connect to power supply Operate unit and record pressures and temperatures	Safety: Do not lift loads from a bending position. Always lift from a squatting position with back straight. Ground power equipment and use with care. Care in the use of hand tools Hazards: Potential back injury or rupture Electrical shock, burn or personal injury Injury to oneself or others
DECISIONS	**CUES**	**ERRORS**
Determine positions of equipment Determine adequate power supply	Survey shows adequate power supply and location of equipment	Equipment set up without proper checks could result in faulty operation of unit

I-3 INSTALL SELF-CONTAINED COMMERCIAL REFRIGERATION UNIT

(TASK STATEMENT)

SCIENCE

Simple machines used to gain mechanical advantage
[STK]
Forces acting on a body immersed or floating in a liquid
[Level]

Behavioral Science:

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
He should consult appropriately when difficulty arises.
He should answer questions which relates to the repair job at hand with honesty and integrity.
He should maintain a proper balance between pressure to complete job and pride in work.
Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.
He should be cautioned to enter only into those customer relations which pertain to the job at hand. Personal entanglements or arguments with customers should always be avoided.
Billing and discussion of costs should be accurate, honest and performed in a straight forward manner.
He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

MATH – NUMBER SYSTEMS

U of Numbers: (without calculation)
[eyeballing floor area]
Ordering– [S.T.K.]
Coding–[mfg. data plate]
Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Arithmetic Skills and Concepts–Rule of thumb
[approximation]
Basic Geometry Skills and Concepts
Knowledge of geometric relationships–Symmetry
[center point]
Determination of area, perimeter and diagonals of polygons with more than 4 sides.
Basic Arithmetic Skills and Concepts—Property of comparison
Basic Measurement Skills and Concepts
Instruments—[tape]
Measurement: Geometric
Linear
Area
Reading and interpreting tables, charts, and graphs–[capacity chart]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Instructions	Process report
Viewing	Survey premises	Visual analysis
Speaking	Verbal instructions	Terminology/General Vocabulary Clarity of expression
Writing	Service order	Informational report Terminology Clarity of expression

(TASK STATEMENT) I-4 INSTALL REMOTE COMMERCIAL CONDENSING UNIT WITH SINGLE CABINET

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

STK
MG
SS-5-6-7-10-12-13-14-
SS-15 or SS-16 according to unit design
SS-25
SS-26

PERFORMANCE KNOWLEDGE

Connect suction and liquid line installing, moisture indicator, sight glass and drier
Connect power supply
Evacuate and charge system
Check pressures and temperatures
Instruct customer—care operation

SAFETY – HAZARD

Safety:

Do not lift loads from a bending position. Always lift from a squatting position with back straight
Ground power equipment and use with care
Always wear goggles when handling refrigerants and use care
Care and use of hand tools

Hazard:

Potential back injury or rupture
Electrical shock-burn or personal injury
Injury to eyes or skin burn
Injury to oneself or others

DECISIONS

Determine location of condensing unit. Set refrigeration equipment in desired location.

CUES

Survey premises for logical placement of condensing unit and adequate power supply.

ERRORS

Failure to perform standard procedures could result in faulty unit operation

I-4 INSTALL REMOTE COMMERCIAL CONDENSING
(TASK STATEMENT) UNIT WITH SINGLE CABINET

SCIENCE

Simple machines used to gain mechanical advantage
[STK]
Effect of heating and cooling on expansion of materials
Effect of heating and cooling on state of matter
[Refrigerant]
Fluids under pressure
[Refrigerant under pressure]
Forces acting on a body immersed or floating in a liquid
[Level]

Behavioral Science:

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
He should consult appropriately when difficulty arises.
He should answer questions which relates to the repair job at hand with honesty and integrity.
He should maintain a proper balance between pressure to complete job and pride in work.
Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.
He should be cautioned to enter only into those customer relations which pertain to the job at hand. Personal entanglements or arguments with customers should always be avoided.
Billing and discussion of costs should be accurate, honest and performed in a straight forward manner.
He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

MATH – NUMBER SYSTEMS

Rationals—Fractions

Use of Numbers: (without calculation)
[eyeballing floor area]
Ordering—[S.T.K.]
Coding—[mfg. data plate]
Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Arithmetic Skills and Concepts--Rule of thumb
[approximation]
Basic Geometry Skills and Concepts
Knowledge of geometric relationships—Symmetry
[center point]
Determination of area, perimeter and diagonals of polygons with more than 4 sides.
Basic Arithmetic Skills and Concepts—Property of comparison
Basic Measurement Skills and Concepts
Instruments—[tape]
Measurement: Geometric
Linear
Area
Reading and interpreting tables, charts, and graphs—[capacity chart]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Instructions	Process report
Viewing	Survey premises	Visual analysis
Speaking	Verbal instructions	Terminology/General Vocabulary Clarity of expression
Writing	Service order	Informational report Terminology Clarity of expression

I-5 INSTALL REMOTE COMMERCIAL CONDENSING UNIT WITH MULTIPLE CABINETS

(TASK STATEMENT)

TOOLS, EQUIPMENT, MATERIALS. OBJECTS ACTED UPON

STK
MG
SS-5-6-7-10-12-12-14
SS-15 or SS-16 according to unit design
SS-25
SS-26

PERFORMANCE KNOWLEDGE

Connect suction and liquid lines with hand valves to each evaporator.
Install drier, sight glass and moisture indicator
Connect power supply
Evacuate and recharge
Check pressures and temperatures
Instruct customer in care operation

SAFETY – HAZARD

Safety:

Do not lift loads from a bending position. Always lift from a squatting position with back straight
Ground power equipment and use with care
Always wear goggles when handling refrigerants and use care
Care and use of hand tools

Hazard:

Potential back injury or rupture
Electrical shock, burn or personal injury
Injury to eyes or skin burn
Injury to oneself or others

DECISIONS

Determine location of condensing unit and cabinets

CUES

Survey premises logical placement of equipment. Check for adequate power supply

ERRORS

Failure to perform standard tasks would result in inefficient or no operation.

I-5 INSTALL REMOTE COMMERCIAL CONDENSING UNIT (TASK STATEMENT) WITH MULTIPLE CABINETS

SCIENCE

Simple machines used to gain mechanical advantage
[STK]
Effect of heating and cooling on expansion of materials
Effect of heating and cooling on state of matter
[Refrigerant]
Fluids under pressure
[refrigerant under pressure]
Forces acting on a body immersed or floating in a liquid
[Level]

Behavioral Science:

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
He should consult appropriately when difficulty arises.
He should answer questions which relates to the repair job at hand with honesty and integrity.
He should maintain a proper balance between pressure to complete job and pride in work.
Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.
He should be cautioned to enter only into those customer relations which pertain to the job at hand. Personal entanglements or arguments with customers should always be avoided.
Billing and discussion of costs should be accurate, honest and performed in a straight forward manner.
He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

MATH — NUMBER SYSTEMS

Rationals Fractions

Use of Numbers: (without calculation)
[eyeballing floor area]
Ordering [S.T.K.]
Coding -[mfg. data plate]
Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Arithmetic Skills and Concepts—Rule of thumb
[approximation]
Basic Geometry Skills and Concepts
Knowledge of geometric relationships—Symmetry
[center point]
Determination of area, perimeter and diagonals of polygons with more than 4 sides.
Basic Arithmetic Skills and Concepts—Property of comparison
Basic Measurement Skills and Concepts
Instruments—[tape]
Measurement: Geometric
Linear
Area
Reading and interpreting tables, charts, and graphs—[capacity chart]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Instructions	Process report
Viewing	Survey premises	Visual analysis
Speaking	Verbal instructions	Terminology/General Vocabulary Clarity of expression
Writing	Service order	Informational report Terminology Clarity of expression

Duty II Troubleshooting Refrigeration and Air Conditioning Equipment

1 Hook hermetic compressor directly to power supply
2 Check circuitry of the compressor protector and relay
3 Check capacitor
4 Check circuitry of defrost system
5 Check circulation fan motors
6 Check and adjust control thermostat
7 Attach manifold and gauges to service valves and check pressures
8 Install in-line service valves and measure pressures
9 Check compressor efficiency
10 Locate leak in a refrigeration system using electronic leak detector
11 Locate leak in a refrigeration system using halide torch
12 Locate leak in a refrigeration system using bubble method
13 Check unit operation—oil level—sight glass—moisture indicator
14 Check and adjust an automatic expansion valve
15 Check, test and adjust thermostatic expansion valve
16 Check and adjust pressure motor control
17 Check and adjust low pressure safety control
18 Check and adjust high pressure safety control
19 Adjust and calibrate oil pressure control
20 Check ice maker for operation
21 Check and adjust water valve
22 Check hot gas defrost solenoid and valve
23 Check humidity with sling psychrometer
24 Check and adjust humidistat
25 Check condensate pump and drain
26 Check blower assembly and filter
27 Check heat pump reversing system
28 Check system for burnout and install cleanup kit
29 Service electronic air cleaner

II-1 HOOK HERMETIC COMPRESSOR DIRECTLY (TASK STATEMENT) TO POWER SUPPLY

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

STK
CS
WM

PERFORMANCE KNOWLEDGE

Hook up CS
Hook up watt meter
Start compressor and observe wattage readings

SAFETY – HAZARD

Safety:

Always disconnect circuit and lock out breaker before working on electrical components
Care in use of hand tools

Hazard:

Electrical shock, electrical burn

Injury to oneself or others

DECISIONS

Isolate compressor
Determine compressor wattage

CUES

Compressor starts and cuts out
Compressor runs hot

ERRORS

Failure to do so would result in faulty diagnosis

II-1 HOOK HERMETIC COMPRESSOR DIRECTLY
ASK STATEMENT) TO POWER SUPPLY

SCIENCE

Simple machines used to gain mechanical advantage
[STK]
Magnetic fields of force
Resistance of materials to flow of electrical current

Behavioral Science.

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
He should consult appropriately when difficulty arises.
He should answer questions which relates to the repair job at hand with honesty and integrity.
He should maintain a proper balance between pressure to complete job and pride in work.
Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.
He should be cautioned to enter only into those customer relations which pertain to the job at hand. Personal entanglements or arguments with customers should always be avoided.
Billing and discussion of costs should be accurate, honest and performed in a straight forward manner.
He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

MATH – NUMBER SYSTEMS

Rational Numbers:

Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Measurement Skills and Concepts
Instruments
Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance
[CS WM]
Basic Logic
Deductive/Inductive--[Deductive diagnosis]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	CS WM	Detail inference
Viewing	CS WM	Visual analysis Detail inference
Writing	Service Order	Informational report Terminology Clarity of expression

II-2 CHECK CIRCUITRY OF THE COMPRESSOR, PROTECTOR AND RELAY

(TASK STATEMENT)

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
STK VOM-Watt meter Wiring Diagram	Isolate circuitry of compressor circuit on wiring diagram Check power supply Check continuity on compressor terminals, protector and relay	Safety: Always disconnect circuit and lock out breaker before working on electrical components Care in use of hand tools Hazard: Electrical shock, electrical burn Injury to oneself or others

DECISIONS	CUES	ERRORS
Determine defective circuit by probing each integral part independently	Unit does not run Unit starts and stops	Improper use of the rules of checking continuity will result in inaccurate reading and diagnosis

II-2 CHECK CIRCUITRY OF THE COMPRESSOR, PROTECTOR AND RELAY

(ASK STATEMENT)

SCIENCE

Simple machines used to gain mechanical advantage
[STK]
Magnetic fields of force
Resistance of materials to flow of electrical current
Effect of heating and cooling on expansion of materials
[bi metal]

Behavioral Science.

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
He should consult appropriately when difficulty arises.
He should answer questions which relates to the repair job at hand with honesty and integrity.
He should maintain a proper balance between pressure to complete job and pride in work.
Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.
He should be cautioned to enter only into those customer relations which pertain to the job at hand. Personal entanglements or arguments with customers should always be avoided.
Billing and discussion of costs should be accurate, honest and performed in a straight forward manner.
He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

MATH — NUMBER SYSTEMS

Rational Numbers

Uses of Numbers: (without calculation)
Coding—[mfg data plate]
Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Measurement Skills and Concepts
Instruments
Given an instrument of measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance
Reading and interpreting tables, charts, and graphs
Representational graphs--[wiring diagram]
Basic Logic
Deductive, Inductive—[Deductive Diagnosis]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Schematic VOM-Continuity	Terminology Wiring diagram Detail/inference
Viewing	Components/Wiring Diagram	Visual analysis Logic Recognition of symbols
Writing	Service Order	Informational report Terminology Clarity of expression

TASK STATEMENT) II-3 CHECK CAPACITOR

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

STK
Capacitor Analyzer

PERFORMANCE KNOWLEDGE

Remove capacitor
Check capacitor
Replace if defective

SAFETY – HAZARD

Safety:

Always disconnect circuit and lock out breaker before working on electrical components
Care in use of hand tools

Hazard:

Electrical shock, electrical burn

Injury to oneself or others

DECISIONS

Determine capacitor for open, short or proper rating in microfarads

CUES

Visual observation or improper reading determines faulty capacitor

ERRORS

Improper use of analyzer or not accounting for power factor would result in improper diagnosis

(ASK STATEMENT) II-3 CHECK CAPACITOR

SCIENCE

Simple machines used to gain mechanical advantage
[STK]
Resistance of materials to flow of electrical current
[flow of current thru capacitor]

Behavioral Science

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
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He should maintain a proper balance between pressure to complete job and pride in work.
Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.
He should be cautioned to enter only into those customer relations which pertain to the job at hand, Personal entanglements or arguments with customers should always be avoided.
Billing and discussion of costs should be accurate, honest and performed in a straight forward manner.
He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

MATH — NUMBER SYSTEMS

Rational Numbers

Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Measurement Skills and Concepts
Instruments
Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.—[CA]
Basic Logic—Deductive/Inductive
[deductive diagnosis]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	CA	Detail inference
Viewing	CA	Detail inference
Writing	Service Order	Informational report Terminology Clarity of expression

(TASK STATEMENT) II-4 CHECK CIRCUITRY OF DEFROST SYSTEM

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
STK VOM Wiring Schematic	Isolate circuitry of defrost system on wiring schematic Locate terminal board and identify each terminal coding, each component Check continuity of timer circuit, heater circuit and defrost terminator circuit	Safety: Always disconnect circuit and lock out breaker before working on electrical components Care in use of hand tools Hazard: Electrical shock, electrical burn Injury to oneself or others

DECISIONS	CUES	ERRORS
Determine defective circuit by probing each intergal circuit independently	Defective circuit found when no continuity appears	Improper use of the rules of checking continuity will result in inaccurate reading and diagnosis

ASK STATEMENT) II-4 CHECK CIRCUITRY OF DEFROST SYSTEM

SCIENCE

Simple machines used to gain mechanical advantage
[STK]
Effect of heating and cooling on expansion of materials
[Bi metal thermostat]

Behavioral Science:

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He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

MATH – NUMBER SYSTEMS

Rational Numbers

Uses of Numbers: (without calculation)—
Coding-*given a coding system*, recognize and identify each unit involved by assigning necessary symbols, numerical or literal
Basic Measurement Skills and Concepts
Reading and interpreting tables, charts, and graphs
Representational graphs—[wiring diagram]
Instruments—[VOM]
Basic Logic—Deductive/Inductive—[Deductive diagnosis]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Schematic VOM-Continuity	Terminology Wiring diagram Detail/inference
Viewing	Components/Wiring diagram	Visual analysis Logic Recognition of symbols
Writing	Service order	Informational report Terminology Clarity of expression

TASK STATEMENT) II-5 CHECK CIRCULATION FAN MOTORS

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

STK
VOM
Wiring Diagram

PERFORMANCE KNOWLEDGE

Cneck power supply to motor
Check continuity
Check for defective bearings

SAFETY – HAZARD

Safety:

Always disconnect circuit and lock out breaker before working on electrical components
Care in use of hand tools
Hazard:

Electrical shock, electrical burn

Injury to oneself or others

DECISIONS

Determine if motor is defective
Determine open circuit to motor

CUES

Motor does not run
Motor hums
Motor noisy

ERRORS

If proper rules of checking continuity are not followed, it will result in an inaccurate diagnosis

(ASK STATEMENT) II-5 CHECK CIRCULATION FAN MOTORS

SCIENCE

Simple machines used to gain mechanical advantage
[STK]
Magnetic fields of force
Resistance of materials to flow of electrical current

Behavioral Science:

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MATH -- NUMBER SYSTEMS

Rational Numbers

Fundamental Operations (Calculation)
Additional algorithm
Subtraction algorithm

Basic Measurement Skills and Concepts
Instruments:
Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.--[VOM]
Reading and interpreting tables, charts, and graphs--Representational graphs [Wiring Diagram]
Basic Logic--Deductive/Inductive
[DD]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Schematic VOM-Continuity	Terminology Wiring diagram Detail/inference
Viewing	Components/Wiring Diagram	Visual analysis Logic Recognition of symbols
Writing	Service Order	Informational report Terminology Clarity of expression

TASK STATEMENT) II-6 CHECK AND ADJUST CONTROL THERMOSTAT

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
STK TI	Check cut in and cut out temperatures Check controls Adjust Remove, and replace	Safety: Always disconnect circuit and lock out breaker before working on electrical components Care in use of hand tools Hazard: Electrical shock, electrical burn Injury to oneself or others

DECISIONS	CUES	ERRORS
Determine if control can be adjusted or must be replaced Determine cut in and cut out settings according to mfg.'s specifications	Compressor does not run Compressor runs all the time Compressor runs too much Refrigerator experiences erratic temperatures	Improper adjustments will result in improper temperatures and possible food spoilage

(ASK STATEMENT) II-6 CHECK AND ADJUST CONTROL THERMOSTAT

SCIENCE

Simple machines used to gain mechanical advantage
[STK]
Fluids under pressure
[Refrigerant under pressure in power tube]
Effect of heating and cooling on expansion of materials
[Expansion of power tube]

Behavioral Science:

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MATH – NUMBER SYSTEMS

Rational Numbers

Uses of Numbers: (without calculation)
Coding [Mfg data plate]
Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Measurement Skills and Concepts- [TT]
Instruments
Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.
Basic Logic
Deductive Inductive -[Diagnosis]

COMMUNICATIONS

PERFORMANCE MODES

Reading

Viewing

Writing

EXAMPLES

Thermister thermometer

Control adjustment

Service order

SKILLS/CONCEPTS

Detail inference

Visual analysis

Informational report
Terminology
Clarity of expression

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II-7 ATTACH MANIFOLD AND GAUGES TO SERVICE (TASK STATEMENT) VALVES AND CHECK PRESSURES

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
STK MG	Attach hose connections Open valve stem	Safety Always wear goggles and use care when handling refrigerants Care and use of hand tools Hazard Injury to eyes or skin burn Injury to oneself or others

DECISIONS	CUES	ERRORS
Determine between the high and low side valves	Locate low side valve and high side valve	Failure to attach gauges to the right valve will result in inadequate readings and possible damage to gauge

35

II-7 ATTACH MANIFOLD AND GAUGES TO SERVICE VALVES AND CHECK PRESSURES

(ASK STATEMENT)

SCIENCE

Fluids under pressure
  [Refrigerant]
Simple machines used to gain mechanical advantage
  [STK]

Behavioral Science:

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MATH -- NUMBER SYSTEMS

Rational Numbers

Fundamental Operations (Calculation)
  Addition algorithm
  Subtraction algorithm
Basic Arithmetic Skills and Concepts
  Ratio and proportion [refrigerant]
  Property of comparison -[measuring]
Basic Measurement Skills and Concepts -[MG]
  Instruments
  Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.
Basic Logic [DD]
  Deductive Inductive

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	MG	Detail inference
Viewing	MG	Detail inference
Writing	Service order	Informational report Terminology Clarity of expression

II-8 INSTALL IN-LINE SERVICE VALVES AND MEASURE PRESSURES

(TASK STATEMENT)

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
S1K MG SS-19	Clean area of tubing where valve will be installed Install valve	Safety Always wear goggles and use care when handling refrigerants Care and use of hand tools Hazard Injury to eyes or skin burn Injury to oneself or others

DECISIONS	CUES	ERRORS
Determine what is suction side or low side and high side	Locate lines (large one, low side--smaller one, high side) or trace lines back from compressor	Failure to identify valves on proper lines would result in obtaining wrong gauge reading, possible damage to gauges

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II-8 INSTALL IN-LINE SERVICE VALVES AND MEASURE PRES-
(TASK STATEMENT) SURES

SCIENCE

Behavioral Science:

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MATH -- NUMBER SYSTEMS

Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Arithmetic Skills and Concepts
Ratio and proportion [Refrigerant]
Property of comparison [measure pressures]
Basic Measurement Skills and Concepts [MG]
Instruments
Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.
Basic Logic
Deductive Inductive [DD]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	MG	Detail inference
Viewing	MG	Detail inference
Writing	Service Order	Informational report Terminology Clarity of expression

38

TASK STATEMENT) II-9 CHECK COMPRESSOR EFFICIENCY

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
STK MG WM	Install manifold and gauges Install watt meter Start unit and observe gauge reading and watt meter reading	Safety Always wear goggles and use care when handling refrigerants Care and use of hand tools Hazard Injury to eyes or skin burn Injury to oneself or others

DECISIONS	CUES	ERRORS
Determine compressor operation by wattage check Determine compressor operation by compresson	Long running time of compressor Erratic system temperatures	Failure to make proper checks would result in complaint not being satisfied

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TASK STATEMENT) II-9 CHECK COMPRESSOR EFFICIENCY

SCIENCE

Behavioral Science:

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MATH – NUMBER SYSTEMS

Rational Numbers

Uses of Numbers: (without calculation)
  Coding—[mfg data plate]
Fundamental Operations (Calculation)
  Addition algorithm
  Subtraction algorithm
Basic Arithmetic Skills and Concepts
  Ratio and proportion—[refrigerant]
  Property of comparison—[measuring]
Basic Measurement Skills and Concepts—[MG and WM]
  Instruments
  Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.
Basic Logic
  Deductive/Inductive--[DD]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	MG WM	Detail inference
Viewing	MG WM	Detail inference
Writing	Service order	Informational report Terminology Clarity of expression

II-10 LOCATE LEAK IN REFRIGERATION SYSTEM USING ELECTRONIC LEAK DETECTOR

TASK STATEMENT)

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

STK
MG
ELD
SS-15 or SS-16 according to manufacturer's specification

PERFORMANCE KNOWLEDGE

Fill system with type of refrigerant used in system
Probe suspected areas with sensor of leak detector

SAFETY – HAZARD

Safety

Always wear goggles and use care when handling refrigerants
Care and use of hand tools

Hazard

Injury to eyes or skin burn
Injury to oneself or others

DECISIONS

Determine probable area of leak

CUES

Locate leak when signal is detected from detector

ERRORS

Improper calibration of sensitivity control or failure to use search and pinpoint correctly, results in mistaken leak.

II-10 LOCATE LEAK IN REFRIGERATION SYSTEM USING (TASK STATEMENT) ELECTRONIC LEAK DETECTOR

SCIENCE

Simple machines used to gain mechanical advantage
[STK]
Effect of heating and cooling on expansion of materials
Effect of heating and cooling on state of matter
[refrigerant]
Fluids under pressure
[refrigerant under pressure]
Transfer of heat from one body to another
[heat transfer evaporator to condenser]

Behavioral Science:

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
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MATH – NUMBER SYSTEMS

Rational Numbers

Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Arithmetic Skills and Concepts
Ratio and proportion—[refrigerant]
Property of comparison—[measuring]
Basic Measurement Skills and Concepts—[MG and ELD]
Instruments
Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.
Basic Logic
Deductive/Inductive—[DD]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	MG	Detail inference
Viewing	MG	Detail inference
Listening	ELD	Noise discrimination Sensor siren
Writing	Service order	Informational report Terminology Clarity of expression

II-11 LOCATE LEAK IN REFRIGERATION SYSTEM (TASK STATEMENT) USING HALIDE TORCH

43

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

STK
MG
HLD
SS-15 or SS-16 according to mfg's specifications

PERFORMANCE KNOWLEDGE

Fill system with type of refrigerant used in system
Probe suspected areas with halide torch

SAFETY – HAZARD

Safety

Always wear goggles and use care when handling refrigerants
Proper ventilation is a necessary precaution when checking with a HLD

Hazard

Injury to eyes or skin burn
Irritating odor to nose and throat

DECISIONS

Determine probable area of leak

CUES

Detects leak when flame changes to a bright blue color

ERRORS

If improper flame color is mistaken for leak; leak would not be detected

II-11 LOCATE LEAK IN REFRIGERATION SYSTEM (SK STATEMENT) USING HALIDE TORCH

SCIENCE

Simple machines used to gain mechanical advantage
[STK]
Effect of heating and cooling on expansion of materials
Effect of heating and cooling on state of matter
[refrigerant]
Fluids under pressure
[refrigerant under pressure]
Transfer of heat from one body to another
[heat transfer evaporator to condenser]

Behavioral Science:

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MATH – NUMBER SYSTEMS

Rational Numbers

Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Arithmetic Skills and Concepts
Ratio and proportion—[refrigerant]
Property of comparison—[measuring]
Basic Measurement Skills and Concepts—[MG and HLD]
Instruments
Given an Instrument of Measur[illegible]termine precision and/or accuracy with respect to relative error, significant digit[illegible] and tolerance.
Basic Logic
Deductive/Inductive—[DD]

COMMUNICATIONS

PERFORMANCE MODES

Reading

Viewing

Writing

EXAMPLES

MG

HLD

Service order

SKILLS/CONCEPTS

Detail inference

Color discrimination
(flame changes color)

Informational report
Terminology
Clarity of expression

II-12 LOCATE LEAK IN REFRIGERATION SYSTEM USING BUBBLE METHOD

(TASK STATEMENT)

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

STK
MG
SS-17

PERFORMANCE KNOWLEDGE

Fill system with Nitrogen
Swab joints and other possible areas where leaks occur

SAFETY – HAZARD

Safety

Always wear goggles and use care when handling refrigerants
Care and use of hand tools

Hazard

Injury to eyes or skin burn
Injury to oneself or others

DECISIONS

Determine probable area of leak

CUES

Detects leak when bubble occurs

ERRORS

Failure to isolate possible source of leak, results in more time and expense required to locate source

45

II-12 LOCATE LEAK IN REFRIGERATION SYSTEM USING (TASK STATEMENT) BUBBLE METHOD

SCIENCE

Simple machines used to gain mechanical advantage
[STK]
Effect of heating and cooling on expansion of materials
Effect of heating and cooling on state of matter
[refrigerant]
Fluids under pressure
[refrigerant under pressure]
Transfer of heat from one body to another
[heat transfer evaporator to condenser]

Behavioral Science:

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MATH — NUMBER SYSTEMS

Rational Numbers

Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Arithmetic Skills and Concepts
Ratio and proportion [refrigerant]
Property of comparison- [measuring]
Basic Measurement Skills and Concepts [MG]
Instruments
Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.
Basic Logic
Deductive/Inductive [DD]

COMMUNICATIONS

PERFORMANCE MODES

Reading

Viewing

Writing

EXAMPLES

MG

Bubble solution swabbed on leak determines area of leak

Service order

SKILLS/CONCEPTS

Detail inference

Visual analysis

Informational report
Terminology
Clarity of expression

II-13 CHECK UNIT OPERATION—OIL LEVEL—SIGHT GLASS—MOISTURE INDICATOR

(TASK STATEMENT)

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

STK
AP

PERFORMANCE KNOWLEDGE

Inspect
Check power supply

SAFETY — HAZARD

Safety

Use care in checking power supply
Care in use of hand tools

Hazard

Severe shock may occur
Injury to oneself or others

DECISIONS

Determine proper oil level, clear sight glass, and color on moisture indicator pad in dry zone

CUES

Locate, oil level, sight glass in separator or compressor base. Sight glass and moisture indicator in liquid line.

ERRORS

Failure to check out properly could result in a needed repair to be over looked

II-13 CHECK UNIT OPERATION—OIL LEVEL—SIGHT GLASS—MOISTURE INDICATOR

(TASK STATEMENT)

SCIENCE

Simple machines used to gain mechanical advantage
[STK]
Effect of heating and cooling on expansion of materials
Effect of heating and cooling on state of matter
[refrigerant]
Fluids under pressure
[refrigerant under pressure]
Transfer of heat from one body to another
[heat transfer evaporator to condenser]

Behavioral Science:

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Billing and discussion of costs should be accurate, honest and performed in a straight forward manner.
He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

MATH — NUMBER SYSTEMS

Uses of Numbers: (without calculation)
Coding—[mfg data plate]
Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Arithmetic Skills and Concepts
Ratio and proportion
Basic Measurement Skills and Concepts—[AP]
Instruments
Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.
Basic Logic
Deductive/Inductive—[DD]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	AP	Detail inference
Viewing	Oil level Sight glass Moisture indicator	Visual analysis
Writing	Service order	Informational report Terminology Clarity of expression

II-14 CHECK AND ADJUST AN AUTOMATIC EXPANSION (TASK STATEMENT) VALVE

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY — HAZARD
STK MG	Inspect expansion valve for ice buildup Check adjustment in relation to low side pressure	Safety Always wear goggles and use care when handling refrigerants Care and use of hand tools Hazard Injury to eyes or skin burn Injury to oneself or others

DECISIONS	CUES	ERRORS
Adjust valve stem clockwise to increase pressure, counter clockwise to decrease pressure to record desired low side pressure	Normal low side pressures will be recorded	Failure to follow the proper adjustment technique would result in faulty performance

64

II-14 CHECK AND ADJUST AN AUTOMATIC EXPANSION (TASK STATEMENT) VALVE

SCIENCE

Simple machines used to gain mechanical advantage
[STK]
Effect of heating and cooling on expansion of materials
Effect of heating and cooling on state of matter
[refrigerant]
Fluids under pressure
[refrigerant under pressure]
Transfer of heat from one body to another
[heat transfer evaporator to condenser]

Behavioral Science:

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Billing and discussion of costs should be accurate, honest and performed in a straight forward manner.
He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

MATH – NUMBER SYSTEMS

Rational Numbers:

Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Arithmetic Skills and Concepts
Ratio and proportion—[refrigerant]
Property of comparison--[measuring]
Basic Measurement Skills and Concepts—[MG]
Instruments
Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.
Basic Logic
Deductive/Inductive—[DD]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	MG	Detail inference
Viewing	Automatic expansion valve	Visual analysis
Writing	Service order	Informational report Terminology Clarity of expression

II-15 CHECK, TEST AND ADJUST THERMOSTATIC (TASK STATEMENT) EXPANSION VALVE

51

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
STK MG (Element tube check/ used in conjunction with R-12-R-22)	Check power element using element tube check and record pressures Adjust to 10° superheat Replace if necessary Check pressures for normal operation	Safety Always wear goggles and use care when handling refrigerants Care and use of hand tools Hazard Injury to eyes or skin burn Injury to oneself or others

DECISIONS	CUES	ERRORS
Determine if TEV is defective or out of adjustment	Normal low side temperatures and pressure will be recorded	Failure to diagnose problem accurately, would result in replacing part unnecessarily

51

II-15 CHECK, TEST AND ADJUST THERMOSTATIC
(TASK STATEMENT) EXPANSION VALVE

SCIENCE

Simple machines used to gain mechanical advantage
[STK]
Effect of heating and cooling on expansion of materials
Effect of heating and cooling on state of matter
[refrigerant]
Fluids under pressure
[refrigerant under pressure]
Transfer of heat from one body to another
[heat transf

Behavioral Science:

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He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

MATH – NUMBER SYSTEMS

Rational Numbers

Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Arithmetic Skills and Concepts
Ratio and proportion [refrigerant]
Property of comparison [measuring]
Basic Measurement Skills and Concepts [MG]
Instruments
Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.
Basic Logic
Deductive Inductive [DD]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	MG	Detail inference
Viewing	TEV	Visual analysis
Writing	Service order	Informational report Terminology Clarity of expression

(TASK STATEMENT) II-16 CHECK AND ADJUST PRESSURE MOTOR CONTROL

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
STK MG	Check gauge readings Check differential and range settings Check cut-in and cut-out settings Make necessary adjustments	Safety Always wear goggles and use care when handling refrigerants Care and use of hand tools Hazard Injury to eyes or skin burn Injury to oneself or others

DECISIONS	CUES	ERRORS
Determine control adjustments to mfg specifications	Correct control settings will provide for normal run time and down time	Failure to meet all adjustment requirements would result in short cycle or an extended run cycle

(TASK STATEMENT) II-16 CHECK AND ADJUST PRESSURE MOTOR CONTROL

SCIENCE

Simple machines used to gain mechanical advantage
[STK]
Fluids under pressure
[refrigerant under pressure in bellows]
Effect of heating and cooling on expansion of materials
[effect of refrigerant on bellows]

Behavioral Science:

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
He should consult appropriately when difficulty arises.
He should answer questions which relates to the repair job at hand with honesty and integrity.
He should maintain a proper balance between pressure to complete job and pride in work.
Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.
He should be cautioned to enter only into those customer relations which pertain to the job at hand. Personal entanglements or arguments with customers should always be avoided.
Billing and discussion of costs should be accurate, honest and performed in a straight forward manner.
He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

MATH – NUMBER SYSTEMS

Rational Numbers:

Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Arithmetic Skills and Concepts
Ratio and proportion–[refrigerant]
Property of comparison–[measuring]
Basic Measurement Skills and Concepts–[MG]
Instruments
Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.
Basic Logic
Deductive/Inductive –[DD]

COMMUNICATIONS

PERFORMANCE MODES

Reading

Viewing

Writing

EXAMPLES

MG

Control adjustments

Service order

SKILLS/CONCEPTS

Detail inference

Visual analysis

Informational report
Terminology
Clarity of expression

TASK STATEMENT) II-17 CHECK AND ADJUST LOW PRESSURE SAFETY CONTROL

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
STK MG	Check gauge readings Check differential and range adjustments Check cut-in and cut-out points Make necessary adjustments	Safety Always wear goggles and use care when handling refrigerants Care and use of hand tools Hazard Injury to eyes or skin burn Injury to oneself or others

DECISIONS	CUES	ERRORS
Determine adjustments according to mfg specifications	If control is functioning compressor will operate and low side pressures will be normal	Failure to recognize low side operating pressures or make incorrect adjustments would cause compressor damage and poor system performance

(TASK STATEMENT) II-17 CHECK AND ADJUST LOW PRESSURE SAFETY CONTROL

SCIENCE

Simple machines used to gain mechanical advantage
[STK]
Fluids under pressure
[refregerant under pressure in bellows]
Effect of heating and cooling on expansion of materials
[bellows assembly]

Behavioral Science:

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Billing and discussion of costs should be accurate, honest and performed in a straight forward manner.
He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

MATH -- NUMBER SYSTEMS

Rational Numbers.

Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Arithmetic Skills and Concepts
Ratio and proportion--[refrigerant]
Property of comparison--[measuring]
Basic Measurement Skills and Concepts--[MG]
Instruments
Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.
Basic Logic
Deductive/Inductive--[DD]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	MG	Detail inference
Viewing	Control adjustments	Visual analysis Detail inference
Writing	Service order	Informational report Terminology Clarity of expression

(TASK STATEMENT) II-18 CHECK AND ADJUST HIGH PRESSURE SAFETY CONTROL

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
SIK MG	Check gauge readings Check differential and range adjustments Check cut-in and cut-out points Make necessary adjustments	Safety Always wear goggles and use care when handling refrigerants Care and use of hand tools Hazard Injury to eyes or skin burn Injury to oneself or others

DECISIONS	CUES	ERRORS
Determine control adjustments to mfg specifications	If control is functioning compressor will operate and high side pressures will be normal	Failure to recognize high side operating pressures or make incorrect adjustments would create short cycling and inefficient performance

(TASK STATEMENT) II-18 CHECK AND ADJUST HIGH PRESSURE SAFETY CONTROL

SCIENCE

Simple machines used to gain mechanical advantage
[STK]
Fluids under pressure
[refrigerant under pressure in bellows]
Effect of heating and cooling on expansion of materials
[expansion of bellows]

Behavioral Science:

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Billing and discussion of costs should be accurate, honest and performed in a straight forward manner.
He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

MATH – NUMBER SYSTEMS

Rational Numbers:

Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Arithmetic Skills and Concepts
Ratio and proportion—[refrigerant]
Property of comparison—[measuring]
Basic Measurement Skills and Concepts—[MG]
Instruments
Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.
Basic Logic
Deductive/Inductive—[DD]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	MG	Detail inference
Viewing	MG	Detail inference
Writing	Service order	Informational report Terminology Clarity of expression

(TASK STATEMENT) II-19 ADJUST AND CALIBRATE OIL PRESSURE SAFETY CONTROL

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
STK MG	Install manifold and gauges Locate control Adjust and calibrate Test and check	Safety: Always wear goggles and use care when handling refrigerants Care and use of hand tools Hazard: Injury to eyes or skin burn Injury to oneself or others

DECISIONS	CUES	ERRORS
Determine adjustments to be made according to mfg. specifications	Unit shut-off Low oil level	Improper adjustment and calibration may result in unit malfunction

(TASK STATEMENT) II-19 ADJUST AND CALIBRATE OIL PRESSURE SAFETY CONTROL

SCIENCE

Simple machines used to gain mechanical advantage
[STK]
Fluids under pressure
[refrigerant under press re in bellows]
Effect of heating and cooling on expansion of materials
[expansion of bellows]

Behavioral Science:

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MATH – NUMBER SYSTEMS

Rational Numbers

Uses of Numbers: (without calculation)
Coding—[mfg. data plate]
Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Arithmetic Skills and Concepts
Ratio and proportion—[refrigerant]
Basic Measurement Skills and Concepts
Instruments—[MG]
Measurement: Non-geometric
Liquid
Weight
Liquid—[effect of refrigerant on control]
Basic Logic
Deductive/Inductive—[deductive diagnosis]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Data plate MG	Detail Inference
Viewing	MG	Detail Inference
Writing	Service order	Informational report Terminology/general vocabulary Clarity of expression

TASK STATEMENT) II-20 CHECK ICE MAKER FOR OPERATION

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
STK VOM Wiring Diagram	Check continuity of ice maker assembly Adjust assembly Remove and/or replace	Safety: Always disconnect circuit and lock out breaker before working on electrical components Care in use of hand tools Hazard: Electrical shock, electrical burn Injury to oneself or others

DECISIONS	CUES	ERRORS
Determine if there is continuity through components of assembly Determine what component is in operation	Water over flows Rotor does not revolve Cubes are not discharged from unit	Failure to find nonfunctioning component would result in erratic operation of ice maker

(TASK STATEMENT) II-20 CHECK ICE MAKER FOR OPERATION

SCIENCE

Simple machines used to gain mechancial advantage.
[STK]
Magnetic fields of force
Resistance of materials to flow of electrical current

Behavioral Science:

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MATH – NUMBER SYSTEMS

Rational Numbers

Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Arithmetic Skills and Concepts
Ratio and proportion- [refrigerant]
Property of comparison—[measure pressures]
Basic Measurement Skills and Concepts—[MG]
Instruments
Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.
Basic Logic
Deductive Inductive - [DD]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Schemetic VOM-Continuity	Terminology Wiring diagram Detail/inference
Viewing	Components/Wiring diagram	Visual analysis Logic Recognition of symbols
Writing	Service order	Informational report Terminology Clarity of expression

(TASK STATEMENT) II-21 CHECK AND ADJUST WATER VALVE

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

STK
MG
TT

PERFORMANCE KNOWLEDGE

Check water inlet temperature
Check water outlet temperature
Adjust water valve stem to correct any temperature difference

SAFETY – HAZARD

Safety

Always wear goggles and use care when handling refrigerants
Care and use of hand tools

Hazard

Injury to eyes or skin burn
Injury to oneself or others

DECISIONS

Determine adjustment according to mfg. specifications

CUES

Normal water temperatures will be maintained, allowing for operating pressures run normal

ERRORS

Failure to make correct adjustment would result in unit operating with excessive head pressure or excessive water consumption

ASK STATEMENT) II-21 CHECK AND ADJUST WATER VALVE

SCIENCE

Simple machines used to gain mechanical advantage
[STK]
Transfer of heat from one body to another
[conduction of condenser coil to water-measuring sensible heat by thermometer]
Effect of heating and cooling on expansion of materials
[expansion and contraction of a bellows]

Behavioral Science:

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MATH – NUMBER SYSTEMS

Rational Numbers

Uses of Numbers: (without calculation)
Coding- [mfg data plate]
Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Arithmetic Skills and Concepts
[effect of refrigerant pressure on bellows]
Basic Measurement Skills and Concepts
Instruments—[thermometer]
Measurement: Non-geometric
Temperature
Weight
Liquid
[refrigerant in system]
Basic Logic
Deductive/Inductive—[deductive diagnosis]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	MG TT	Detail inference
Viewing	MG TT	Visual analysis
Touching	TT	Temperature
Writing	Service Order	Informational report Terminology Clarity of expression

(TASK STATEMENT) II-22 CHECK HOT GAS DEFROST SOLENOID AND VALVE

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TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
STK VOM	Check mechanical operation of valve Check solenoid continuity	Safety: Always disconnect circuit and lock out breaker before working on electrical components Hazard: Electrical shock -electrical burn

DECISIONS	CUES	ERRORS
Determine if hot gas defrost solenoid value is cycling Determine if defrost trip mechanism is operative	Cooling coil has frost build-up Cooling area has higher than normal temperatures	Improper diagnosis will result in continued defrost malfunction

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(TASK STATEMENT) II-22 CHECK HOT GAS DEFROST SOLENOID AND VALVE

SCIENCE

Simple machines used to gain mechanical advantage
[STK]

Behavioral Science:

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MATH – NUMBER SYSTEMS

Rational Numbers

Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Measurement Skills and Concepts
Instruments—[VOM]
Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance
Deductive/Inductive—[Deductive Diagnosis]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Schemetic VOM-Continuity	Terminology Wiring diagram Detail/inference
Viewing	Components/Wiring diagram	Visual analysis Logic Recognition of symbols
Writing	Service order	Informational report Terminology Clarity of expression

(TASK STATEMENT). II-23 CHECK HUMIDITY WITH SLING PSYCHROMETER

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
SP Distilled water	Operate sling psychrometer Record readings in several locations Record outside readings	

DECISIONS	CUES	ERRORS
Determine humidity conditions	To record a reading of 50-55% relative humidity	Inaccurate reading could result in improper diagnosis—unit too small

ASK STATEMENT) II-23 CHECK HUMIDITY WITH SLING PSYCHROMETER

SCIENCE

Effect of heating and cooling on state of matter
[humidity effect on element]
Resistance of materials to change in shape
[Hydroscopic element expanding & contracting (stretching)]
Effect of heating and cooling on expansion of materials
[Spirit thermometers]

Behavioral Science:

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MATH – NUMBER SYSTEMS

Rational Numbers

Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorit.
Basic Arithmetic Skills and Concepts
Property of comparision –[measurement of psychrometer scale]
Basic Measurement Skills and Concepts
instruments--[psychrometer]
Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance—[psychrometer and instrument of measure]
Measurement: Non-geometric
[thermometers in psychrometer]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	SP	Detail inference
Touch	Thermometers in SP	Temperature
Writing	Service order	Informational report Terminology Clarity of expression

(TASK STATEMENT) II-24 CHECK AND ADJUST HUMIDISTAT

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
STK	Locate control Check hydroscopic element Adjust Test	Safety Always disconnect circuit and lock out breaker before working on electrical components Care in use of hand tools Hazard· Electrical shock, elec burn Injury to oneself or others

DECISIONS	CUES	ERRORS
Determine control needs adjustment or replacement	Too much humidity in warm season Dryness in cold season	Failure to make proper adjustment or placement will cause uncomfortable air conditioning conditions

(TASK STATEMENT) II-24 CHECK AND ADJUST HUMIDISTAT

SCIENCE

Simple machines used to gain mechanical advantage
[STK]
Hydroscopic element expands ond contracts due to moisture in air

Behavioral Science:

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MATH – NUMBER SYSTEMS

Rational Numbers

Fundamental Operations (Calculation)
Addition algorithm
Suhtraction algorithm
Basic Logic
Deductive Inductive--[deductive diagnosis]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Humidistat	Visual analysis
Writing	Service order	Informational report Terminology Clarity of expression

(TASK STATEMENT) **II-25 CHECK CONDENSATE PUMP AND DRAIN**

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
STK VOM	Check power supply to pump motor Check motor for continuity Check or adjust mechanical float and arm for proper level Inspect drain	Safety: Always disconnect circuit and lock out breaker before working on electrical components Care in use of hand tools Hazard: Electrical shock, electrical burn Injury to oneself or others

DECISIONS	CUES	ERRORS
Determine if pump or motor are faulty or drain plugged	Motor does not run Motor runs but does not pump	Failure to make proper test and adjustment will result in excessive water build-up in condensate tray

TASK STATEMENT) h-25 CHECK CONDENSATE PUMP AND DRAIN

SCIENCE

Simple machines used to gain mechanical advantage
[STK]
Magnetic fields of force
Resistance of materials to flow of electrical current

Behavioral Science.

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MATH – NUMBER SYSTEMS

Rational Numbers

Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Measurement Skills and Concepts
Instruments
Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.
[VUM]
Basic Logic
Deductive Inductive [DD]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Schematic VOM-Continuity	Terminology Wiring diagram Detail/inference
Viewing	Components/Wiring diagram	Visual analysis Logic Recognition of symbols
Writing	Service order	Informational report Terminology Clarity of expression

(TASK STATEMENT) **II-26 CHECK BLOWER ASSEMBLY AND FILTER**

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
STK VOM	Check filter Check power supply if blower motor is inoperative. Check and adjust belt Check motor bearings and oil Replace any defective components	Safety: Always disconnect circuit and lock out breaker before working on electrical components Care in use of hand tools Hazard: Electrical shock, electrical burn Injury to oneself or others

DECISIONS	CUES	ERRORS
Determine if malfunction is mechanical or electrical Determine blower assembly specifications according to mfg. specifications	No heat or cooling Noisy Temperatures too high or too low	Failure to make proper diagnosis would result in replacing unnecessary parts and/or not solving the complaint

(TASK STATEMENT) II-26 CHECK BLOWER ASSEMBLY AND FILTER

SCIENCE

Simple machines used to gain mechanical advantage
[STK]
Magnetic fields of force
Resistance of materials to flow of electrical current

Behavioral Science:

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Billing and discussion of costs should be accurate, honest and performed in a straight forward manner
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MATH – NUMBER SYSTEMS

Rational Numbers

Functional Operations (Calculation)
Additional algorithm
Subtraction algorithm

Basic Measurement Skills and Concepts
Instruments:
Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.—[VOM]
Reading and interpreting tables, charts, and graphs—Representational graphs [Wiring Diagram]
Basic Logic—Deductive/Inductive
[DD]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Schematic VOM-continuity	Terminology Wiring diagram Detail/inference
Viewing	Components/Wiring diagram	Visual analysis Logic Recognition of symbols
Writing	Service order	Informational report Terminology Clarity of expression

(TASK STATEMENT) **II-27 CHECK HEAT PUMP REVERSING SYSTEM**

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
STK VOM MG	Check thermostat circuit to solenoid valves Check operation of reversing and check valves Check system pressures Remove and replace any defective component according to mfg. specifications	Safety Always wear goggles and use care when handling refrigerants Care and use of hand tools Hazard Injury to eyes or skin burn Injury to oneself or others

DECISIONS	CUES	ERRORS
Determine if reversing valves are manual or electrically operated Determine type of system according to mfg's specifications	Unit runs—no heat Unit runs—no cooling	Failure to properly identify proper reversing system would result in improper diagnosis and repair

(TASK STATEMENT) II-27 CHECK HEAT PUMP REVERSING SYSTEM

SCIENCE

Behavioral Science:

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MATH – NUMBER SYSTEMS

Rational Numbers

Uses of Numbers: (without calculation)
  Coding—[mfg data plate]
Fundamental Operations (Calculation)
  Addition algorithm
  Subtraction algorithm
Basic Arithmetic Skills and Concepts
  Ratio and proportion—[refrigerant]
  Property of comparison—[measuring]
Basic Measurement Skills and Concepts—[MG and WM]
  Instruments
  Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.
Basic Logic
  Deductive/Inductive—[DD]

COMMUNICATIONS

PERFORMANCE MODES

Reading
Viewing
Writing

EXAMPLES

MG
VOM
Service order

SKILLS/CONCEPTS

Detail inference

Informational report
Terminology
Clarity of expression

II-28 CHECK SYSTEM FOR BURNOUT AND INSTALL CLEANUP KIT

TASK STATEMENT)

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TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
STK System cleaner (sporlan) Acid test kit	Remove compressor Install replacement compressor, system cleaner and drier Evacuate Recharge Test oil for color and acidity Remove system cleaner	Safety Always wear goggles and use care when handling refrigerants Care and use of hand tools Hazard Injury to eyes or skin burn Injury to oneself or others
DECISIONS	**CUES**	**ERRORS**
Determine if burnout has occurred by following the electrical tests recommended by the equipment mfg. Determine size of unit and the proper cleaning procedure to be used.	Compressor inoperative No refrigeration	Failure to determine if a burnout has occurred, and a new compressor is installed without proper cleanout will result in future system and compressor failure

II-28 CHECK SYSTEM FOR BURNOUT AND INSTALL CLEANUP KIT

(ASK STATEMENT)

SCIENCE

Simple machines used to gain mechanical advantage
[STK]
Fluids under pressure
[refrigerant]

Behavioral Science

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MATH – NUMBER SYSTEMS

Rational Numbers

Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Arithmetic Skills and Concepts
Ratio and proportion—[refrigerant]
Property of comparision—[measuring]
Basic Measurement Skills and Concepts—[MG]
Instruments
Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Data plate MG	Detail inference
Viewing	MG	Detail inference
Writing	Service order	Informational report Terminology/general vocabulary Clarity of expression

TASK STATEMENT) **II-29 SERVICE ELECTRONIC AIR CLEANER**

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
STK VOM	Check power supply and disconnect Remove filters and clean Replace any defective component according to mfg's specifications	Safety: Always disconnect circuit and lock out breaker before working on electrical components Care in use of hand tools Hazard: Electrical shock, electrical burn Injury to oneself or others

DECISIONS	CUES	ERRORS
Determine what type electronic air cleaner is installed on system If self cleaning, check water supply	Customer discomfort Air has high rate of pollen, dust Unit not functioning properly—short cycling	Failure to determine what type is installed would result in improper service or needless replacement of components

ASK STATEMENT) II-29 SERVICE ELECTRONIC AIR CLEANER

SCIENCE

Behavioral Science

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
He should consult appropriately when difficulty arises.
He should answer questions which relates to the repair job at hand with honesty and integrity
He should maintain a proper balance between pressure to complete job and pride in work.
Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.
He should be cautioned to enter only into those customer relations which pertain to the job at hand. Personal entanglements or arguments with customers should always be avoided.
Billing and discussion of costs should be accurate, honest and performed in a straight forward manner.
He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

MATH — NUMBER SYSTEMS

Rational Numbers

Uses of Numbers: (without calculation)—
Coding-*given a coding system*, recognize and identify each unit involved by assigning necessary symbols, numerical or literal
Basic Measurement Skills and Concepts
Reading and interpreting tables, charts, and graphs
Representational graphs—[wiring diagram]
Instruments—[VOM]
Basic Logic—Deductive/Inductive—[Deductive diagnosis]

COMMUNICATIONS

PERFORMANCE MODES

Reading

Viewing

Writing

EXAMPLES

Schemetic
VOM-Continuity

Components/Wiring Diagram

Service order

SKILLS/CONCEPTS

Terminology
Wiring diagram
Detail/inference

Visual analysis

Logic
Recognition of symbols

Informational report
Terminology
Clarity of expression

Duty III Servicing and Repairing Refrigeration and Air Conditioning Equipment

1 Evacuate a refrigeration system
2 Pump system down into receiver tank
3 Recharge system using sight glass
4 Recharge system weighing in refrigerent
5 Fill dial a charge
6 Recharge a refrigeration system using dial a charge
7 Remove and replace control thermostat
8 Remove and replace defrost timer
9 Remove and replace motor overload protector
10 Remove and replace capacitor
11 Remove and replace defrost heater
12 Remove and replace defrost terminator
13 Remove and replace relay
14 Remove and replace fan motors
15 Repair leak in copper lines of system
16 Remove and replace compressor
17 Add oil to system
18 Remove restriction from capillary tube
19 Remove and replace capillary tube
20 Remove and replace automatic expansion valve
21 Remove and replace thermostatic expansion valve
22 Install a drier, sight glass or moisture indicator
23 Remove and replace high or low pressure safety control
24 Remove and replace high or low pressure motor control
25 Remove and replace oil pressure safety control
26 Remove and replace hot gas defrost solenoid and valve
27 Repair evaporator with epoxy
28 Remove and replace condensation pump motor
29 Remove and replace humidistat
30 Balance the air conditioning system

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(TASK STATEMENT) III-1 EVACUATE A REFRIGERATION SYSTEM

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Set of Standard Tools Vacuum pump Manifold and gauge	Run pump until gauge reads and holds at 29.9° vacuum	· Safety Always wear goggles and use care when handling refrigerants Care and use of hand tools Hazard Injury to eyes or skin burn Injury to oneself or others

DECISIONS	CUES	ERRORS
Attach vacuum pump and evacuate system	Remove all cont.. ninants and moisture	Failure to completely evacuate the system would result in possible inefficient cooling when recharged

ASK STATEMENT) III-1 EVACUATE A REFRIGERATION SYSTEM

SCIENCE

Simple machines used to gain mechanical advantage
[STK]
Fluids under pressure
[refrigerant]

Behavioral Science:

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
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He should maintain a proper balance between pressure to complete job and pride in work
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Billing and discussion of costs should be accurate, honest and performed in a straight forward manner.
He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism

MATH – NUMBER SYSTEMS

Rational Numbers

Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Arithmetic Skills and Concepts
Ratio and proportion [refrigerant]
Property of comparison [measuring]
Basic Measurement Skills and Concepts [MG]
Instruments
Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Data plate MG	Detail inference
Viewing	MG	Detail inference
Writing	Service order	Informational report Terminology/general vocabulary Clarity of expression

(TASK STATEMENT) III-2 PUMP SYSTEM DOWN INTO RECEIVER TANK

TOOLS, EQUIPMENT MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
STK MG	Locate receiver tank close valve to liquid line Start unit Observe gauges Close suction service valve	Safety: Proper care and use of hand tools Hazard: Personal injury could occur

DECISIONS	CUES	ERRORS
Determine how to evacuate system to isolate component for repair	Component must be changed System must be evacuated	Failure to properly evacuate system would result in possible loss of refrigerant or exposing system to moisture

(TASK STATEMENT) III-2 PUMP SYSTEM DOWN INTO RECEIVER TANK

SCIENCE

Simple machines used to gain mechanical advantage
[STK]
Fluids under pressure
[refrigerant]

Behavioral Science

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
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He should maintain a proper balance between pressure to complete job and pride in work
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Billing and discussion of costs should be accurate, honest and performed in a straight forward manner.
He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism

MATH – NUMBER SYSTEMS

Rational Numbers

Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Arithmetic Skills and Concepts
Ratio and proportion [refrigerant]
Property of comparison [measuring]
Basic Measurement Skills and Concepts
Instruments
Given an Instrument of Measure determine precision and/or accuracy with respect to relative error, significant digits and tolerance.

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	MG	Detail inference
Viewing	MG	Detail inference
Writing	Service order	Informational report Terminology Clarity of expression

(TASK STATEMENT) III-3 RECHARGE SYSTEM USING SIGHT GLASS

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

Set of Standard Tools
Manifold and gauges
Tank of refrigerant 12 or 22
(as specified for unit)

PERFORMANCE KNOWLEDGE

Evacuate system
Start unit
Observe pressures
Observe refrigerant flow through sight glass

SAFETY – HAZARD

Safety

Always wear goggles and use care when handling refrigerants
Care and use of hand tools

Hazard

Injury to eyes or skin burn
Injury to oneself or others

DECISIONS

Attach tank to low side and charge in vapor form

CUES

To charge the system by observing the sight glass until it clears

ERRORS

Failure to follow the prescribed method of charging with vapor with the unit running, would cause damage to the compressor

(TASK STATEMENT) III-3 RECHARGE SYSTEM USING SIGHT GLASS

SCIENCE

Behavioral Science

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MATH – NUMBER SYSTEMS

Rational Numbers

Fundamental Operations (Calculation)
  Addition algorithm
  Subtraction algorithm
Basic Arithmetic Skills and Concepts
  Ratio and proportion [refrigerant]
  Property of comparison [measuring]
Basic Measurement Skills and Concepts [MG]
  Instruments
  Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.
Basic Logic
  Deductive Inductive [DD]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Data plate MG	Detail inference
Viewing	MG	Detail inference
Writing	Service order	Informational report Terminology/general vocabulary Clarity of expression

(TASK STATEMENT) **III-4 RECHARGE A SYSTEM WEIGHING IN REFRIGERANT**

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Set of Standard Tools Manifold and gauges Tank of refrigerant (as specified for unit) Scale	Evacuate system Purge line from tank to manifold Obtain total weight of tank Observe what the total weight should be with full charge in system	Safety Always wear goggles and use care when handling refrigerants Care and use of hand tools Hazard Injury to eyes or skin burn Injury to oneself or others

DECISIONS	CUES	ERRORS
Determine charge until specified amount is taken into system	Charge the system with refrigerant by measuring in the correct weight as found on the mfg name plate located on the unit	Miscalculation could result in under charge or over charge affecting performance of unit

(TASK STATEMENT) III-4 RECHARGE A SYSTEM WEIGHING IN REFRIGERANT

SCIENCE

Behavioral Science:

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Billing and discussion of costs should be accurate, honest and performed in a straight forward manner.
He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism

MATH – NUMBER SYSTEMS

Rational Numbers

Fundamental Operations (Calculation)
  Addition algorithm
  Subtraction algorithm
Basic Arithmetic Skills and Concepts
  Ratio and proportion [refrigerant]
  Property of comparison [measuring]
Basic Measurement Skills and Concepts [MG]
  Instruments
  Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.
Basic Logic
  Deductive Inductive [DD]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Data plate MG	Detail inference
Viewing	MG	Detail inference
Writing	Service order	Informational report Terminology/general vocabulary Clarity of expression

(TASK STATEMENT) **III-5 FILL DIAL A CHARGE**

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
DC SS-15 or SS-16 according to mfg's specifications	Set up dial and charger to hook-up supply tank Fill charger	Safety Always wear goggles and use care when handling refrigerants Care and use of hand tools Hazard Injury to eyes or skin burn Injury to oneself or others

DECISIONS	CUES	ERRORS
Determine type and amount of refrigerant required	Amount of refrigerant required Type of refrigerant required	Improper amount or type would cause poor performance

(TASK STATEMENT) III-5 FILL DIAL A CHARGE

SCIENCE

Behavioral Science:

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Billing and discussion of costs should be accurate, honest and performed in a straight forward manner.
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MATH – NUMBER SYSTEMS

Rational Numbers

Uses of Numbers (without calculation)
  Coding [mfg Data Plate]
Fundamental Operations (Calculation)
  Addition algorithm
  Subtraction algorithm
Basic Arithmetic Skills and Concepts
  Ratio and proportion [refrigerant]
  Property of comparison [measuring]
Basic Measurement Skills and Concepts
  Instruments
  Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.
  [dial a charge]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Data plate DC	Detail inference
Viewing	DC	Detail inference
Writing	Service order	Informational report Terminology Clarity of expression

(TASK STATEMENT) III-6 RECHARGE A REFRIGERATION SYSTEM USING DIAL A CHARGE

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TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

Set of Standard Tools
Manifold and gauges
Dial a charge (filled to mfg specified amount of refrigerant)

PERFORMANCE KNOWLEDGE

Evacuate system
Purge line from dial a charge to manifold
Start unit and observe gauges
Check pressures and temperatures

SAFETY – HAZARD

Safety

Always wear goggles and use care when handling refrigerants
Care and use of hand tools

Hazard

Injury to eyes or skin burn
Injury to oneself or others

DECISIONS

Determine correct charge for low side with specified amount of refrigerant

CUES

Measure into the system the exact amout of refrigerant specified

ERRORS

Failing to calculate the proper pressure of dial a charge and measuring scale would result in an over charge or an under charge

(TASK STATEMENT) III-6 RECHARGE A REFRIGERATION SYSTEM USING DIAL A CHARGE

SCIENCE

Simple machines used to gain mechanical advantage
[STK, valve wrench]
Effect of heating and cooling on expansion of materials
Effect of heating and cooling on state of matter
[refrigerant]
Fluids under pressure
[refrigerant under at. press]
Transfer of heat from one body to another
[heat transfer evaporator condenser]

Behavioral Science:

Technician should talk only about the repair job and in a knowledgeable way, and p[illegible] note his employer whenever possible.
He [illegible]uld consult appropriately when difficulty arises
He [illegible]uld answer questions which relates to the repair job at hand with honesty and integrity.
He should maintain a proper balance between pressure to complete job and pride in work.
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Billing and discussion of costs should be accurate, honest and performed in a straight ferward manner.
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MATH – NUMBER SYSTEMS

Rational Numbers

Uses of Numbers, (without calculation)
Coding [mfg. data plate]
Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Arithmetic Skills and Concepts
Ratio and proportion [refrigerant]
Property of comparison [dial a charge]
Basic Measurement Skills and Concepts
Instruments [dial a charge manifold & gauges]
Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.
Measurement' (Non-geometric)—[refrigerant]
Temperature
Weight
Liquid

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Data plate Dial a charge	Detail inference
Writing	Service order	Informational report Terminology/general vocabulary Clarity of expression
Viewing	Dial a charge	Detail inference

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(TASK STATEMENT) **III-7 REMOVE AND REPLACE CONTROL THERMOSTAT**

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
STK MG	Install manifold and gauges Locate and remove control Install replacement control Check and test control	Safety Always wear goggles and use care when handling refrigerants Care and use of hand tools Hazard Injury to eyes or skin burn Injury to oneself or others

DECISIONS	CUES	ERRORS
Determine control in operative Select replacement according to mfg. model and serial number	Adjustment can not be made with accuracy Power element has lost charge Open circuit	Incorrect replacement will result in improper installation, and erratic cooling coil temperatures.

(TASK STATEMENT) III-7 REMOVE AND REPLACE CONTROL THERMOSTAT

SCIENCE

Simple machines used to gain mechanical advantage
[STK]
Fluids under pressure
[refrigerant under pressure in bellows]
Effect of heating and cooling on expansion of materials
[power element in thermostat]

Behavioral Science

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible
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Billing and discussion of costs should be accurate, honest and performed in a straight forward manner
He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism

MATH -- NUMBER SYSTEMS

Rational Numbers

Uses of Numbers (without calculation)
Coding [mfg data plate]
Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Measurement Skills and Concepts [MG]
Instruments
Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.

COMMUNICATIONS

PERFORMANCE MODES

Reading

Viewing

Writing

EXAMPLES

Data plate
MG

MG

Service order

SKILLS/CONCEPTS

Detail inference

Detail inference

Informational report
Terminology/general vocabulary
Clarity of expression

(TASK STATEMENT) III-8 REMOVE AND REPLACE DEFROST TIMER

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

STK
Wiring Diagram

PERFORMANCE KNOWLEDGE

Locate defrost timer
Remove from mounting
Install and test

SAFETY – HAZARD

Safety:

Always disconnect circuit and lock out breaker before working on electrical components
Care in use of hand tools

Hazard

Electrical shock, electrical burn

Injury to oneself or others

DECISIONS

Determine if defrost timer is defective
Select replacement timer according to unit model and serial number

CUES

Defrost timer shorted
Defrost timer has open circuit

ERRORS

Failure to make correct replacement would result in a longer or shorter defrost cycle

(TASK STATEMENT) III-8 REMOVE AND REPLACE DEFROST TIMER

SCIENCE

Simple machines used to gain mecahnical advantage
[SINK]
Effect of heating and cooling on expansion of materials
[bi metal]
Resistance of materials to flow of electrical current
[motor turning timer mechanism]

Behavioral Science:

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MATH – NUMBER SYSTEMS

Rational Numbers

Use of Numbers: (without caluclation)
Coding [mfg data plate]
Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Measurement Skills and Concepts
Reading and interpreting tables, charts, and graphs
Representational graphs

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Data plate Wiring diagram	Detail inference
Viewing	Components Wiring diagram	Visual analysis Recognition of symbols, codes emblems
Writing	Service order	Informational report Terminology/general vocabulary Clarity of expression

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(TASK STATEMENT) **III-9 REMOVE AND REPLACE MOTOR OVERLOAD PROTECTOR**

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

STK
Wiring Diagram

PERFORMANCE KNOWLEDGE

Locate compressor and remove overload protector
Check rating and reinstall replacement protector

SAFETY – HAZARD

Safety:

Always disconnect circuit and lock out breaker before working on electrical components
Care in use of hand tools

Hazard:

Electrical shock, electrical burn

Injury to oneself or others

DECISIONS

Determine protector defective
Select proper rated protector according to mfg. specifications

CUES

Overload protector weak
Overload protector has open circuit

ERRORS

Failure to do so could cause unit damage

TASK STATEMENT) III-9 REMOVE AND REPLACE MOTOR OVERLOAD PROTECTOR

SCIENCE

Simple machines used to gain mechanical advantage
[STK]
Effect of heating and cooling on expansion of materials
[Bi metal]

Behavioral Science.

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Billing and discussion of costs should be accurate, honest and performed in a straight forward manner.
He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

MATH – NUMBER SYSTEMS

Rational Numbers

Use of Numbers (without calculation)
Coding [mfg. data plate]
Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Measurement Skills and Concepts
Reading and interpreting tables, charts, and graphs
Representational graphs

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Data plate Wiring diagram	Detail inference
Viewing	Components Wiring diagram	Visual analysis Recognition of symbols, codes emblems
Writing	Service order	Informational report Terminology/general vocabulary Clarity of expression

(TASK STATEMENT) III-10 REMOVE AND REPLACE CAPACITOR

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
STK Wiring Diagram	Locate motor Remove capacitor Replace with new capacitor	Safety: Always disconnect circuit and lock out breaker before working on electrical components Care in use of hand tools Hazard: Electrical shock, electrical burn Injury to onesell or others

DECISIONS	CUES	ERRORS
Determine capacitor defective Select capacitor with correct mfg. rating	Capacitor leaks Motor does not start Capacitor shorted or has open circuit	Failure to do so would result in damage to motor or compressor

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'ASK STATEMENT) III-10 REMOVE AND REPLACE CAPACITOR

SCIENCE

Simple machines used to gain mechanical advantage
[STK]
Resistance of materials to flow of electrical current
[flow of current]

Behavioral Science:

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He should maintain a proper balance between pressure to complete job and pride in work.
Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.
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Billing and discussion of costs should be accurate, honest and performed in a straight forward manner.
He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

MATH – NUMBER SYSTEMS

Rational Numbers

Use of Numbers: (without caluclation)
Coding [mtg. data plate]
Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Measurement Skills and Concepts
Reading and interpreting tables, charts, and graphs
Representational graphs

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Data plate Wiring diagram	Detail inference
Viewing	Components Wiring diagram	Visual analysis Recognition of symbols, codes emblems
Writing	Service order	Informational report Terminology/general vocabulary Clarity of expression

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(TASK STATEMENT) III-11 REMOVE AND REPLACE DEFROST HEATER

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

STK
Wiring Diagram

PERFORMANCE KNOWLEDGE

Remove heater from cooling coil assembly
Install new heater
Reinstall cooling coil assembly

SAFETY – HAZARD

Safety:

Always disconnect circuit and lock out breaker before working on electrical components
Care in use of hand tools

Hazard:

Electrical shock, electrical burn

Injury to oneself or others

DECISIONS

Determine defrost heater inoperative
Select defrost heater according to model and serial number

CUES

Fresh food compartment warmer than normal
Ice build-up in freezer near cooling coil

ERRORS

Failure to select correct heater would result in not being able to replace heater

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(TASK STATEMENT) III-11 REMOVE AND REPLACE DEFROST HEATER

SCIENCE

Simple machines used to gain mechanical advantage
[STK]

Behavioral Science:

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He should maintain a proper balance between pressure to complete job and pride in work.
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Billing and discussion of costs should be accurate, honest and performed in a straight forward manner.
He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism

MATH – NUMBER SYSTEMS

Rational Numbers

Use of Numbers: (without caluclation)
Coding [mfg. data plate]
Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Measurement Skills and Concepts
Reading and interpreting tables, charts, and graphs
Representational graphs

COMMUNICATIONS

PERFORMANCE MODES

Reading

Viewing

Writing

EXAMPLES

Data plate
Wiring diagram

Components
Wiring diagram

Service order

SKILLS/CONCEPTS

Detail inference

Visual analysis
Recognition of symbols, codes emblems

Informational report
Terminology/general vocabulary
Clarity of expression

103

(TASK STATEMENT) III-12 REMOVE AND REPLACE DEFROST TERMINATOR

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

STK
Wiring Diagram

PERFORMANCE KNOWLEDGE

Locate defrost terminator in cooling coil section
Remove defrost terminator
Install new defrost terminator

SAFETY – HAZARD

Safety:

Always disconnect circuit and lock out breaker before working on electrical components
Care in use of hand tools

Hazard:

Electrical shock, electrical burn

Injury to oneself or others

DECISIONS

Determine defrost terminator defective
Select replacement according to model and serial number
Check cut out temp on new terminator

CUES

Defrost terminator has open circuit

ERRORS

Failure to make correct replacement will result in a longer or shorted defrost cycle

ASK STATEMENT) III-12 REMOVE AND REPLACE DEFROST TERMINATOR

SCIENCE

Simple machines used to gain mechanical advantage
[STK]
Effect of heating and cooling on expansion of materials
[bi metal]

Behavioral Science:

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He should maintain a proper balance between pressure to complete job and pride in work.
Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.
He should be cautioned to enter only into those customer relations which pertain to the job at hand. Personal entanglements or arguments with customers should always be avoided.
Billing and discussion of costs should be accurate, honest and performed in a straight forward manner.
He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

MATH — NUMBER SYSTEMS

Rational Numbers

Use of Numbers: (without caluclation)
Coding- -[mfg. data plate]
Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Measurement Skills and Concepts
Reading and interpreting tables, charts, and graphs
Representational graphs

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Data plate Wiring diagram	Detail inference
Viewing	Components Wiring diagram	Visual analysis Recognition of symbols, codes emblems
Writing	Service order	Informational report Terminology/general vocabulary Clarity of expression

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(TASK STATEMENT) III-13 REMOVE AND REPLACE RELAY

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

STK
Wiring Diagram

PERFORMANCE KNOWLEDGE

Locate relay
Remove relay
Install relay
Test and check

SAFETY – HAZARD

Safety:

Always disconnect circuit and lock out breaker before working on electrical components
Care in use of hand tools

Hazard:

Electrical shock, electrical burn

Injury to oneself or others

DECISIONS

Determine relay inoperative
Select relay rated to HP of compressor

CUES

Relay has open circuit
Compressor starts and stops

ERRORS

Failure to install correct size relay would render unit inoperative

(TASK STATEMENT) III-13 REMOVE AND REPLACE RELAY

SCIENCE

Simple machines used to gain mechanical advantage
[STK]
Effect of heating and cooling on expansion of materials
[Bi metal]

Behavioral Science:

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
He should consult appropriately when difficulty arises.
He should answer questions which relates to the repair job at hand with honesty and integrity.
He should maintain a proper balance between pressure to complete job and pride in work.
Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.
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Billing and discussion of costs should be accurate, honest and performed in a straight forward manner.
He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

MATH – NUMBER SYSTEMS

Rational Numbers

Use of Numbers: (without caluclation)
Coding---[mtg. data plate]
Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Measurement Skills and Concepts
Reading and interpreting tables, charts, and graphs
Representational graphs

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Data plate Wiring diagram	Detail inference
Viewing	Components Wiring diagram	Visual analysis Recognition of symbols, codes emblems
Writing	Service order	Informational report Terminology/general vocabulary Clarity of expression

(TASK STATEMENT) III-14 REMOVE AND REPLACE FAN MOTORS

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

STK
Wiring Diagram

PERFORMANCE KNOWLEDGE

Locate motor
Remove motor
Replace motor
Test and check

SAFETY – HAZARD

Safety:

Always disconnect circuit and lock out breaker before working on electrical components
Care in use of hand tools

Hazard:

Electrical shock, electrical burn

Injury to oneself or others

DECISIONS

Determine motor inoperative
Select motor designed for application

CUES

Motor shorted
Motor has open circuit
Motor has defective bearings

ERRORS

Failure to replace with motor designed will result in inefficient unit operation

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(TASK STATEMENT) III-14 REMOVE AND REPLACE FAN MOTORS

SCIENCE

Simple machines used to gain mechanical advantage
[STK]
Magnetic fields of force
Resistance of materials to flow of electrical current

Behavioral Science:

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
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He should maintain a proper balance between pressure to complete job and pride in work.
Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.
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Billing and discussion of costs should be accurate, honest and performed in a straight forward manner.
He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

MATH – NUMBER SYSTEMS

Rational Numbers

Use of Numbers: (without caluclation)
Coding [mfg data plate]
Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Measurement Skills and Concepts
Reading and interpreting tables, charts, and graphs
Representational graphs

COMMUNICATIONS

PERFORMANCE MODES

Reading

Viewing

Writing

EXAMPLES

Data plate
Wiring diagram

Components
Wiring diagram

Service order

SKILLS/CONCEPTS

Detail inference

Vis[illegible]/sis
Re[illegible] of symbols, codes emblems

Inform[illegible]l report
Term[illegible]y/general vocabulary
Clarity [illegible]xpression

(TASK STATEMENT) III-15 REPAIR LEAK IN COPPER LINES OF SYSTEM

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
STK MG VP PT SS-4 SS-3 SS-7 SS-6	Repair copper line with flared mechanical fitting or with a swedge and/or brazed joint Evacuate Recharge	Safety: Proper care and use [illegible] tools Ventilate room when [illegible]ing Use care while torch [illegible] peration Wear goggles when handling refrigerant Hazard: Personal injury could occur Burn off irritating to eyes, nose and throat Severe burns or property damage may occur Loss of eyesight or skin burns

DECISIONS	CUES	ERRORS
Determine severity of leak Determine type of fitting needed to complete task	Oil slick in area of leak Leak detector methods have isolated area of leak	Failure to determine severity of leak or make good repair would cause unit to continue leaking

(TASK STATEMENT) III-15 REPAIR LEAK IN COPPER LINES OF SYSTEM

SCIENCE

Simple machines used to gain mechanical advantage
[STK]
Effect of heating and cooling on state of matter
[brazing]
Fluids under pressure
[refrigerant]
Resistance of materials to change in shape
[tube bending, swedge, flare]

Behavioral Science:

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
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He should maintain a proper balance between pressure to complete job and pride in work.
Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.
He should be cautioned to enter only into those customer relations which pertain to the job at hand. Personal entanglements or arguments with customers should always be avoided.
Billing and discussion of costs should be accurate, honest and performed in a straight forward manner.
He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

MATH – NUMBER SYSTEMS

Rational Numbers

Uses of Numbers: (without calculation)
Coding—[mfg. data plate]
Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Arithmetic Skills and Concepts
Ratio and proportion—[refrigerant]
Property of comparision—[measuring in refrigerant charge]
Basic Measurement Skills and Concepts—[MG]
Instruments
Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.
Basic Logic
Deductive/Inductive—[deductive diagnosis]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	MG	Detail inference
Writing	Service order	Informational report Terminology/general vocabulary Clarity of expression
Viewing	MG	Detail inference

(TASK STATEMENT) III-16 REMOVE AND REPLACE COMPRESSOR

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

STK
MG
VP
SS-15 or SS-16 according to mfg's specifications

PERFORMANCE KNOWLEDGE

Locate compressor and remove from mounting
Install replacement compressor
Evacuate
Recharge
Test and check

SAFETY – HAZARDS

Safety

Always wear goggles and use care when handling refrigerants
Care and use of hand tools

Hazard

Injury to eyes or skin burn
Injury to oneself or others

DECISIONS

Determine compressor defective
Select replacement compressor according to mfg's specifications and model and serial number

CUES

Compressor shorted
Compressor has open winding
Compressor has mechanical failure

ERRORS

Failure to install proper sized compressor will result in no operation or ineffective operation of unit

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(TASK STATEMENT) III-16 REMOVE AND REPLACE COMPRESSOR

SCIENCE

Simple machines used to gain mechanical advantage
[STK]
Effect of heating and cooling on state of matter
[soldering]
Transfer of heat from one body to another
[heat conduction]
Effect of heating and cooling on expansion of materials
[refrigerant]
Fluids under pressure
[refrigerant under pressure]

Behavioral Science:

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
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He should maintain a proper balance between pressure to complete job and pride in work.
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Billing and discussion of costs should be accurate, honest and performed in a straight forward manner.
He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

MATH – NUMBER SYSTEMS

Rational Numbers

Uses of Numbers: (without calculation)
Coding --[mfg data plate]
Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Arithmetic Skills and Concepts
Ratio and proportion--[refrigerant]
Property of comparison--[measuring]
Basic Measurement Skills and Concepts--[MG]
Instruments
Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Data plate MG	Detail inference
Viewing	MG	Detail inference
Writing	Service order	Informational report Terminology/general vocabulary Clarity of expression

(TASK STATEMENT) III-17 ADD OIL TO SYSTEM

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
STK Manifold & gauges SS-15 or SS-16 WM Refrigeration oil	Take system to vacuum on low side Introduce oil into low side until operating wattage becomes normal or compressor quiets down Recharge	Safety Always wear goggles and use care when handling refrigerants Care and use of hand tools Hazard Injury to eyes or skin burn Injury to oneself or others

DECISIONS	CUES	ERRORS
Determine how much oil has been lost from compressor	Unit runs excessively hot Unit has high wattage reading Unit short cycles	Too much or too little oil will render inefficient operation of unit

(TASK STATEMENT) III-17 ADD OIL TO SYSTEM

SCIENCE

Simple machines used to gain mechanical advantage
[STK]
Effect of heating and cooling on expansion of materials
Effect of heating and cooling on state of matter
[refrigerant]
Fluids under pressure
[refrigerant under pressure]
Transfer of heat from one body to another
[heat]

Behavioral Science:

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Billing and discussion of costs should be accurate, honest and performed in a straight forward manner.
He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

MATH — NUMBER SYSTEMS

Rational Numbers

Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Arithmetic Skills and Concepts
Ratio and proprotion -[refrigerant]
Property of comparison [measuring]
Basic Measurement Skills and Concepts -[MG, WM]
Instruments
Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Data plate MG WM	Detail inference
Writing	Service order	Informational report Terminology/general vocabulary Clarity of expression
Viewing	MG WM	Detail inference

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(TASK STATEMENT) III-18 REMOVE RESTRICTION FROM CAPILLARY TUBE

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
STK MG VP SS-12 SS-15 o: SS-17	Remove high side end of capillary tube Flush and back flush R-22 or nitrogen Install drive Evacuate Recharge	Safety Always wear goggles and use care when handling refrigerants Care and use of hand tools Hazard Injury to eyes or skin burn Injury to oneself or others

DECISIONS	CUES	ERRORS
Determine if capillary tube is operative	Gauges read moderate restriction	No refrigerant passes through tube

(TASK STATEMENT) III-18 REMOVE RESTRICTION FROM CAPILLARY TUBE

SCIENCE

Simple machines used to gain mechanical advantage
[STK]
Effect of heating and cooling on state of matter
[Soldering-refrigerant]
Fluids under pressure
[refrigerant under pressure]
Transfer of heat from one body to another
[heat conduction]
Effect of heating and cooling on expansion of materials
[refrigerant]

Behavioral Science:

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Billing and discussion of costs should be accurate, honest and performed in a straight forward manner.
He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

MATH – NUMBER SYSTEMS

Rational Numbers

Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Arithmetic Skills and Concepts
Ratio and proportion -[refrigerant]
Property of comparison--[measuring]
Basic Measurement Skills and Concepts -[MG]
Instruments
Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Data plate MG	Detail inference
Viewing	MG	Detail inference
Writing	Service order	Informational report Terminology/general vocabulary Clarity of expression

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(TASK STATEMENT) III-19 REMOVE AND REPLACE CAPILLARY TUBE

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

STK
MG
VP

PERFORMANCE KNOWLEDGE

Remove capillary tube
Install replacement
Evacuate
Recharge

SAFETY – HAZARD

Safety

Always wear goggles and use care when handling refrigerants
Care and use of hand tools

Hazard

Injury to eyes or skin burn
Injury to oneself or others

DECISIONS

Determine if capillary tube is inoperative
Select correct capillary tube according to compressor capacity, and condenser design

CUES

Evaporator pressures reflect a restriction
Capillary tube plugged

ERRORS

Failure to install correct capillary tube would result in higher or lower evaporator temperature

(TASK STATEMENT) III-19 REMOVE AND REPLACE CAPILLARY TUBE

SCIENCE

Behavioral Science:

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Billing and discussion of costs should be accurate, honest and performed in a straight forward manner
He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism

MATH – NUMBER SYSTEMS

Rational Numbers

Uses of Numbers: (without calculation)
coding [mfg data plate]
Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Arithmetic Skills and Concepts
Ratio and proportion- [refrigerant]
Property of comparision- [measuring]
Basic Measurement Skills and Concepts- [MG]
Instruments
Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Data plate MG	Detail inference
Viewing	MG	Detail inference
Writing	Service order	Informational report Terminology/general vocabulary Clarity of expression

(TASK STATEMENT) III-20 REMOVE AND REPLACE AUTOMATIC EXPANSION VALVE

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

STK
MG
TI
SS-15 or SS-16 according to mfg specifications

PERFORMANCE KNOWLEDGE

Install manifold and gauges
Isolate automatic expansion valve from system
Remove automatic expansion valve
Replace with new automatic expansion valve
Purge and add refrigerant to system
Adjust to cooling coil temperature

SAFETY – HAZARD

Safety

Always wear goggles and use care when handling refrigerants
Care and use of hand tools

Hazard

Injury to eyes or skin burn
Injury to oneself or others

DECISIONS

Determine if automatic expansion valve is inoperative
Select proper automatic expansion valve according to unit design

CUES

AXV operates erratic
AXV internal valve defective

ERRORS

Failure to do so will result in system not functioning properly

(TASK STATEMENT) III-20 REMOVE AND REPLACE AUTOMATIC EXPANSION VALVE

SCIENCE

Behavioral Science:

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He should maintain a proper balance between pressure to complete job and pride in work.
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Billing and discussion of costs should be accurate, honest and performed in a straight forward manner.
He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

MATH – NUMBER SYSTEMS

Rational Numbers

Uses of Numbers: (without calcualtion)
coding—[mfg data plate]
Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Arithmetic Skills and Concepts
Ratio and proportion—[refrigerant]
Property of comparison—[measuring]
Basic Measurement Skills and Concepts—[MG]
Instruments
Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	MG TI	Detail inference
Writing	Service order	Informational report Terminology/general vocabulary Clarity of expression
Viewing	MG TI	Detail inference

(TASK STATEMENT) III-21 REMOVE AND REPLACE THERMOSTATIC EXPANSION VALVE

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

STK
MG
SS-15 or SS-16 according to mfg's specifications

PERFORMANCE KNOWLEDGE

Install manifold and gauge
Isolate thermostatic expansion valve from system
Remove thermostatic expansion valve
Install replacement thermostatic expansion valve
Add additional charge to system
Adjust super heat

SAFETY – HAZARD

Safety

Always wear goggles and use care when handling refrigerants
Care and use of hand tools

Hazard

Injury to eyes or skin burn
Injury to oneself or others

DECISIONS

Determine if thermostatic expansion valve is inoperative
Select correct thermostatic expansion valve according to unit design

CUES

Cooling coil temperature erratic
Sensor has lost its charge
Internal valve sticking

ERRORS

Failure to install correct valve would result in improper evaporator temperature

(TASK STATEMENT) III-21 REMOVE AND REPLACE THERMOSTATIC EXPANSION VALVE

SCIENCE

Simple machines used to gain mechanical advantage
[STK]
Effect of heating and cooling on expansion of materials
Effect of heating and cooling on state of matter
[refrigerant]
Fluids under pressure
[refrigerant under pressure]
Transfer of heat from one body to another
[heat transfer evaporator to condenser]

Behavioral Science:

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
He should consult appropriately when difficulty arises.
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He should maintain a proper balance between pressure to complete job and pride in work.
Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.
He should be cautioned to enter only into those customer relations which pertain to the job at hand. Personal entanglements or arguments with customers should always be avoided.
Billing and discussion of costs should be accurate, honest and performed in a straight forward manner.
He should get along with his fellow employee and develop a relationship that will not hurt each other. professionalism.

MATH – NUMBER SYSTEMS

Rational Numbers

Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Arithmetic Skills and Concepts
Ratio and proportion--[refrigerant]
Property of comparison--[measuring]
Basic Measurement Skills and Concepts --[MG]
Instruments
Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.
Basic Logic
Deductive Inductive [DD]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Data plate MG	Detail inference
Viewing	MG	Detail inference
Writing	Service order	Informational report Terminology/general vocabulary Clarity of expression

(TASK STATEMENT) III-22 INSTALL A DRIER, SIGHT GLASS OR MOISTURE INDICATOR

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
STK MG SS-15 or SS-16 according to mfg's specifications	Isolate area where component is to be installed Install component Purge component Recharge Check system pressures	Safety Always wear goggles and use care when handling refrigerants Care and use of hand tools Hazard Injury to eyes or skin burn Injury to oneself or others

DECISIONS	CUES	ERRORS
Determine where component to be installed Check mfg. specifications	System requires component Excessive moisture in system Extensive service performed on unit	Failure to follow procedures will result in components not performing adequately

(TASK STATEMENT) III-22 INSTALL A DRIER, SIGHT GLASS OR MOISTURE INDICATOR

SCIENCE

Behavioral Science:

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He should maintain a proper balance between pressure to complete job and pride in work.
Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.
He should be cautioned to enter only into those customer relations which pertain to the job at hand. Personal entanglements or arguments with customers should always be avoided.
Billing and discussion of costs should be accurate, honest and performed in a straight forward manner.
He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

MATH – NUMBER SYSTEMS

Rational Numbers

Uses of Numbers: (without calculation)
  Coding [mfg data plate]
Fundamental Operations (Calculation)
  Addition algorithm
  Subtraction algorithm
Basic Arithmetic Skills and Concepts
  Ratio and proportion [refrigerant]
  Property of comparison- [measuring]
Basic Measurement Skills and Concepts- [MG]
  Instruments
  Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Data plate MG	Detail inference
Viewing	MG	Detail inference
Writing	Service order	Informational report Terminology/general vocabulary Clarity of expression

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III-23 REMOVE AND REPLACE HIGH OR LOW PRESSURE
(TASK STATEMENT) SAFETY CONTROL

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY — HAZARD
STK . MG	Install manifold and gauges Remove control Install new control Wire control Adjust control	Safety: Use care in handling of refrigerants Disconnect power before replacing control Hazard: May cause eye injury or skin burn May cause service electrical supply

DECISIONS	CUES	ERRORS
Determine control inoperative Select control according to unit design	Cannot adjust low cut-out Cannot adjust high cut-out	Improper unit operation will occur

III-23 REMOVE AND REPLACE HIGH OR LOW PRESSURE SAFETY CONTROL (TASK STATEMENT)

SCIENCE

Simple machines used to gain mechanical advantage
[STK]
Fluids under pressure
[refrigerant under pressure in bellows]
Effect of heating and cooling on expansion of materials
[effect of expansion in bellows]

Behavioral Science:

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
He should consult appropriately when difficulty arises.
He should answer questions which relates to the repair job at hand with honesty and integrity.
He should maintain a proper balance between pressure to complete job and pride in work.
Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.
He should be cautioned to enter only into those customer relations which pertain to the job at hand. Personal entanglements or arguments with customers should always be avoided.
Billing and discussion of costs should be accurate, honest and performed in a straight forward manner.
He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

MATH – NUMBER SYSTEMS

Rational Numbers:

Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Arithmetic Skills and Concepts
Ratio and proportion—[refrigerant]
Property of comparison—[measuring]
Basic Measurement Skills and Concepts—[MG]
Instruments
Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.
Basic Logic
Deductive Inductive—[DD]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Data plate MG	Detail inference
Viewing	MG	Detail inference
Writing	Service order	Informational report Terminology/general vocabulary Clarity of expression

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III-24 REMOVE AND REPLACE HIGH OR LOW PRESSURE MOTOR CONTROL

(TASK STATEMENT)

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
STK MG	Install manifold and gauges Remove control Install new control Wire control Adjust and calibrate control	Safety Always wear goggles and use care when handling refrigerants Care and use of hand tools Hazard Injury to eyes or skin burn Injury to oneself or others

DECISIONS	CUES	ERRORS
Determine control inoperative Select control according to unit design	Control cannot be adjusted or calibrated with accuracy Control has open circuit	Incorrect control will result in improper cycling

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III-24 REMOVE AND REPLACE HIGH OR LOW PRESSURE MOTOR CONTROL

(TASK STATEMENT)

SCIENCE

Simple machines used to gain mechanical advantage
[STK]
Fluids under pressure
[refrigerant under pressure in bellows]
Effect of heating and cooling on expansion of material
[effect of expansion in bellows]

Behavioral Science:

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
He should consult appropriately when difficulty arises.
He should answer questions which relates to the repair job at hand with honesty and integrity.
He should maintain a proper balance between pressure to complete job and pride in work.
Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.
He should be cautioned to enter only into those customer relations which pertain to the job at hand. Personal entanglements or arguments with customers should always be avoided.
Billing and discussion of costs should be accurate, honest and performed in a straight forward manner.
He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

MATH – NUMBER SYSTEMS

Rational Numbers:

Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Arithmetic Skills and Concepts
Ratio and proportion --[refrigerant]
Property of comparison—[measuring]
Basic Measurement Skills and Concepts—[MG]
Instruments
Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.
Basic Logic
Deductive/Inductive—[DD]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Data plate MG	Detail inference
Viewing	MG	Detail inference
Writing	Service order	Informational report Terminology/general vocabulary Clarity of expression

(TASK STATEMENT) III-25 REMOVE AND REPLACE OIL PRESSURE SAFETY CONTROL

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

STK
MG

PERFORMANCE KNOWLEDGE

Install manifold and gauges
Remove control
Install new control
Adjust and calibrate control

SAFETY – HAZARD

Safety

Always wear goggles and use care when handling refrigerants
Care and use of hand tools

Hazard

Injury to eyes or skin burn
Injury to oneself or others

DECISIONS

Determine control inoperative
Select replacement according to mfg specifications

CUES

Adjustments or calibration cannot be made with accuracy
Open circuit

ERRORS

Failure to install correct control may result in system failure

ASK STATEMENT) III-25 REMOVE AND REPLACE OIL PRESSURE SAFETY CONTROL

SCIENCE

Simple machines used to gain mechanical advantage
[STK]
Fluids under pressure
[refrigerant under pressure in bellows]
Effect of heating and cooling on expansion of materials
[effect of expansion in bellows]

Behavioral Science:

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
He should consult appropriately when difficulty arises.
He should answer questions which relates to the repair job at hand with honesty and integrity.
He should maintain a proper balance between pressure to complete job and pride in work.
Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.
He should be cautioned to enter only into those customer relations which pertain to the job at hand. Personal entanglements or arguments with customers should always be avoided.
Billing and discussion of costs should be accurate, honest and performed in a straight forward manner.
He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

MATH – NUMBER SYSTEMS

Rational Numbers

Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Arithmetic Skills and Concepts
Ratio and proportion--[refrigerant]
Property of comparison--[measuring]
Basic Measurement Skills and Concepts--[MG]
Instruments
Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.
Basic Logic
Deductive, Inductive--[DD]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Data plate MG	Detail inference
Viewing	MG	Detail inference
Writing	Service order	Informational report Terminology/general vocabulary Clarity of expression

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III-26 REMOVE AND REPLACE HOT GAS DEFROST SOLENOID AND VALVE

(TASK STATEMENT)

132

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

STK
MG
SS-15 or SS-16 according to mfg's specification

PERFORMANCE KNOWLEDGE

Install manifold and gauges
Isolate HGDSV from system
Remove HGDSV
Replace HGDSV
Purge and add charge or refrigerant to system level

SAFETY – HAZARD

Safety

Always wear goggles and use care when handling refrigerants
Care and use of hand tools

Hazard

Injury to eyes or skin burn
Injury to oneself or others

DECISIONS

Determine HGDSV inoperative
Select correct replacement according to unit design or mfg specifications

CUES

HGDSV solenoid has open circuit
Mechanical operation of valve is erratic

ERRORS

Incorrect replacement will result in continued defrost problems

III-26 REMOVE AND REPLACE HOT GAS DEFROST (TASK STATEMENT) SOLENOID AND VALVE

SCIENCE

Behavioral Science:

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He should maintain a proper balance between pressure to complete job and pride in work.
Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.
He should be cautioned to enter only into those customer relations which pertain to the job at hand. Personal entanglements or arguments with customers should always be avoided.
Billing and discussion of costs should be accurate, honest and performed in a straight forward manner.
He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

MATH — NUMBER SYSTEMS

Rational Numbers

Uses of Numbers: (without calculation)
coding--[mfg data plate]
Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Arithmetic Skills and Concepts
Ratio and proportion--[refrigerant]
Property of comparision--[measuring]
Basic Measurement Skills and Concepts—[MG]
Instruments
Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Data plate MG	Detail inference
Viewing	MG	Detail inference
Writing	Service order	Informational report Terminology/general vocabulary Clarity of expression

(TASK STATEMENT) III-27 REPAIR EVAPORATOR WITH EPOXY

134

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

STK
Epoxy patch kit
Heat Lamp
MG
DC
SS-15 or SS-16 according to mfg's specifications

PERFORMANCE KNOWLEDGE

Clean area
Apply epoxy
Blow to dry
Evacuate
Recharge

SAFETY – HAZARD

Safety:

Care while using epoxy patch
Use goggles while handling refrigerants

Hazard:

Irritates skin
Eye injury or skin burn

DECISIONS

Determine size and area of puncture

CUES

Locate puncture in evaporator

ERRORS

Failure to cover entire area with epoxy will render job unsuccessful

(TASK STATEMENT) III-27 REPAIR EVAPORATOR WITH EPOXY

SCIENCE

Simple machines used to gain mechanical advantage
[STK]
Effect of heating and cooling on expansion of materials
Effect of heating and cooling on state of matter.
[refrigerant]
Fluids under pressure
[refrigerant under pressure]
Transfer of heat from one body to another
[Heat transfer evaporator to condenser]
Relationship of force to distortion in an elastic body
[epoxy]

MATH – NUMBER SYSTEMS

Rational Numbers

Uses of Numbers, (without calculation)
Coding--[mfg Data Plate]
Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Arithmetic Skills and Concepts
Ratio and proportion--[refrigerant]
Property of comparison--[measure]
Basic Measurement Skills and Concepts--[MG, DC]
Instruments
Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	MG DC	Detail inference
Writing	Service order	Informational report Terminology/general vocabulary Clarity of expression
Viewing	MG DC	Detail inference

135

135

(TASK STATEMENT) III-28 REMOVE AND REPLACE CONDENSATION PUMP MOTOR

136

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TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
STK Wiring Diagram	Locate pump Remove pump Replace pump Test float	Safety: Always disconnect circuit and lock out breaker before working on electrical components Care in use of hand tools Hazard: Electrical shock, electrical burn Injury to oneself or others

DECISIONS	CUES	ERRORS
Determine pump design as a replacement	Float arm sticks from corrosion Pump motor has open circuit Pump motor shorted	Improper float adjustment can result in condensate pan overflowing with water

(TASK STATEMENT) III-28 REMOVE AND REPLACE CONDENSATION PUMP MOTOR

SCIENCE

Simple machines used to gain mecahnical advantage
[STK]
Resistance of materials to flow of el. .cal current
[stock potential of current]

Behavioral Science:

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
He should consult appropriately when difficulty arises.
He should answer questions which relates to the repair job at hand with honesty and integrity.
He should maintain a proper balance between pressure to complete job and pride in work.
Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.
He should be cautioned to enter only into those customer relations which pertain to the job at hand. Personal entanglements or arguments with customers should always be avoided.
Billing and discussion of costs should be accurate, honest and performed in a straight forward manner.
He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

MATH — NUMBER SYSTEMS

Rational Numbers

Use of Numbers: (without caluclation)
Coding—[mfg. data plate]
Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Measurement Skills a .d Concepts
Reading and interpreting tables, charts, and graphs
Representational graphs

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Data plate Wiring diagram	Detail inference
Viewing	Components Wiring diagram	Visual analysis Recognition of symbols, codes emblems
Writing	Service order	Informational report Terminology/general vocabulary Clarity of expression

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(TASK STATEMENT) III-29 REMOVE AND REPLACE HUMIDISTAT

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
STK Wiring Diagram	Remove control Replace new control Adjust Test	Safety: Always disconnect circuit and lock out breaker before working on electrical components Care in use of hand tools Hazard: Electrical shock, electrical burn Injury to oneself or others

DECISIONS	CUES	ERRORS
Determine control inoperative Determine replacement control according to mfg. specification	Triggering mechanism distorted Open circuit Failure to adjust control	Failure to replace and adjust control will result in poor climate conditions

(TASK STATEMENT) F.-29 REMOVE AND REPLACE HUMIDISTAT

SCIENCE

Simple machines used to gain mechanical advantage
[STK]
[Effect of moisture on the Hyposcopic element]

Behavioral Science:

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He should maintain a proper balance between pressure to complete job and pride in work.
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Billing and discussion of costs should be accurate, honest and performed in a straight forward manner.
He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

MATH – NUMBER SYSTEMS

Rational Numbers

Use of Numbers: (without caluclation)
Coding—[mfg data plate]
Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Measurement Skills and Concepts
Reading and interpreting tables, charts, and graphs
Representational graphs

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Data plate Wiring diagram	Detail inference
Viewing	Components Wiring diagram	Visual analysis Recognition of symbols, codes emblems
Writing	Service order	Informational report Terminology/general vocabulary Clarity of expression

139

(TASK STATEMENT) III-30 BALANCING THE AIR CONDITIONING SYSTEM

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

STK
Thermometer

PERFORMANCE KNOWLEDGE

Measure temperatures at supply and return duct
Adjust fan speed
Adjust fan cut-in and cut-out and high limit switches
Adjust supply registers and dampers

SAFETY – HAZARD

Safety-

Observe proper use of hand tools and test equipment

Could cause personal injury to oneself or others

DECISIONS

Determine if air distribution is adequate
Determine proper control adjustments according to mfgs.

CUES

Inadequate heating or cooling comfort in certain areas
Humidity too high

ERRORS

Failure to isolate where air distribution is causing customer discomfort and make accurate adjustments would result in customer dissatisfaction

(TASK STATEMENT) III-30 BALANCING THE AIR CONDITIONING SYSTEM

SCIENCE

Indestructibility of energy and matter.
[STK]
Work input, work output, friction and efficiency in simple machines
[Blower]
Centrifugal forces developed by bodies in rotation. [Blower]

Behavioral Science:

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He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism

MATH – NUMBER SYSTEMS

Rational Numbers

Use of numbers without calculation
coding [mfg. data plate]
Fundamental operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic measurement skills and concepts
Instruments [thermometer]
Measurement (non-geometric)
Weight
Temperature
Basic geometry skills and concepts
Geometric relationships [ducts]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Schemetic VOM-Continuity	Terminology Wiring diagram Detail inference
Viewing	Components/Wiring diagram	Visual analysis Logic Recognition of symbols
Writing	Service order	Informational report Terminology Clarity of expression

Duty IV Installing Warm Air Heating Systems

1 Install furnace gas—oil—electric

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(TASK STATEMENT) IV-1 INSTALL FURNACE GAS—OIL—ELECTRIC

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
STK SS-1-5-6-7-8-9 25-26	Position furnace Install blower package Install duct work Install plumbing Wire furnace Check operation	Do not lift loads from a bending position. Always lift from a squatting position with back straight Ground power equipment and use with care Care in the use of hand tools Care in working with gas, oil, electric power Potential back injury or rupture Electrical shock or personal injury Injury to oneself or others Explosion or fire

DECISIONS	CUES	ERRORS
Determine location for furnace Position furnace for accessibility to chimney and duct work	Survey premises for proper fuel supply, power supply and proper size unit	Inadequate utilities or improper positioning or adequate size unit would result in faulty installation

ASK STATEMENT) IV-1 INSTALL FURNACE GAS—OIL—ELECTRIC

SCIENCE

Simple machines used to gain mechanical advantage [STK]
Work input, work output friction and efficiency. [V belt drive on blower]
Effect of heating cooling on expansion of
materials [bi metal]
Centrifugal forces developed by bodies in rotation [Blower blade]

Behavioral Science.

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
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He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism

MATH – NUMBER SYSTEMS

Rationals—Fractions

Use of Numbers: (without calculation)
[eyeballing floor area]
Ordering—[S.T.K.]
Coding—[mfg. data plate]
Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Arithmetic Skills and Concepts—Rule of thumb
[approximation]
Basic Geometry Skills and Concepts
Knowledge of geometric relationships—Symmetry
[center point]
Determination of area, perimeter and diagonals of polygons with more than 4 sides.
Basic Arithmetic Skills and Concepts—Property of comparison
Basic Measurement Skills and Concepts
Instruments—[tape]
Measurement: Geometric
Linear
Area
Reading and interpreting tables, charts, and graphs—[capacity chart]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Instructions	Process report
Viewing	Survey premises	Visual analysis
Speaking	Give instructions	Terminology/general vocabulary Clarity of expression
Writing	Service order	Informational report Terminology Clarity of expression

Duty V Troubleshooting Warm Air Heating Systems

1 Check oil supply
2 Check oil pump
3 Check ignition system
4 Check heat exchanger
5 Check pilotband thermocouple assembly
6 Check wall thermostat
7 Check gas valve assembly
8 Check and adjust fan control
9 Check and adjust limit control
10 Check and adjust oil burner
11 Check natural gas manifold pressure

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(TASK STATEMENT) V-1 CHECK OIL SUPPLY

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
STK VG	Check storage tank Check filter Check nozzle Check suction line on pump Check pump Check ignition components	Safety Proper care and use of hand tools Hazard Injuries to oneself or others

DECISIONS	CUES	ERRORS
Determine if oil is being supplied to chamber	No heat Unit runs but cycles on safety	Failure to locate lack of oil supply could result in unnecessary time on the job.

(TASK STATEMENT) V-1 CHECK OIL SUPPLY

SCIENCE

STK
Oil supply
Simple machines used to gain mechanical advantage [STK]
Effect of heating and cooling on expansion of
materials [Bimetal]
Fluids under pressure [Oil]

Behavior Science:

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Billing and discussion of costs should be accurate, honest and performed in a straight forward manner.
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MATH – NUMBER SYSTEMS

Rational Numbers:

Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Arithmetic Skills and Concepts
Ratio and proportion—oil
Basic Measurement Skills and Concepts
Instruments
Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.
Basic Logic
Deductive/Inductive

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Instructions	Process report
Viewing	Survey premises	Visual analysis
Speaking	Verbal instructions	Terminology/General Vocabulary Clarity of expression
Writing	Service order	Informational report Terminology Clarity of expression

(TASK STATEMENT) **V-2 CHECK OIL PUMP**

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
STK Vacuum gauge	Locate pump Hook up vacuum gauge Determine proper pump	Proper care and use of hand tools Hazard Injuries to oneself or others

DECISIONS	CUES	ERRORS
Determine type of pump and possibility of component failure	No heat No oil in chamber Unit cycles on safety	Failure to make proper diagnosis would result in replacing pump without cause

ASK STATEMENT) V-2 CHECK OIL PUMP

SCIENCE

STK
Oil supply

Simple machines used to gain mechanical advantage [STK]
Effect of heating and cooling on expansion of materials [Bimetal]
Fluids under pressure [Oil]

Behavior Science:

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He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

MATH – NUMBER SYSTEMS

Rational Numbers:

Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Arithmetic Skills and Concepts
Ratio and proportion—oil
Basic Measurement Skills and Concepts
Instruments
Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.
Basic Logic
Deductive/Inductive

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Instructions	Process report
Viewing	Survey premises	Visual analysis
Speaking	Verbal instructions	Terminology/General Vocabulary Clarity of expression
Writing	Service order	Informational report Terminology Clarity of expression

(TASK STATEMENT) **V-3 CHECK IGNITION SYSTEM**

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
STK VOM	Check power supply to unit Check ignition transformer Check electrodes Check cad cell Clean and adjust Check operation	Proper care and use of hand tools Use care in check of power supply Hazard Injury to oneself or others may occur

DECISIONS	CUES	ERRORS
Determine what electrical component is defective or may need adjustment	No heat	Failure to make correct diagnosis would result in improper repair

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(TASK STATEMENT) V-3 CHECK IGNITION SYSTEM

SCIENCE

Simple machines used to gain mechanical advantage [STK]
Effect of heating and cooling on expansion of
materials [Bimetal]
Fluids under pressure [Oil]

Behavior Science:

Technician should talk o. , about the repair job and in a knowledgeable way, and promote his employer whenever possible.
He should consult with superiors when difficulty arises.
He should answer questions which relates to the repair job at hand with honesty and integrity.
He should maintain a proper balance between pressure to complete job and pride in work.
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He should be cautioned to enter only into those customer relations which pertain to the job at hand. Personal entanglements or arguments with customers should always be avoided.
Billing and discussion of costs should be accurate, honest and performed in a straight forward manner.
He should get alcng with his fellow employee and develop a relationship that will not hurt each others professionalism.

MATH – NUMBER SYSTEMS

Rational Numbers:

Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Arithmetic Skills and Concepts
Ratio and proportion—oil
Basic Measurement Skills and Concepts
Instruments
Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.
Basic Logic
Deductive/Inductive

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Schematic VOM continuity	Terminology Detail inference Visual analysis
Viewing	Components—Wiring diagram	Logic Recognition of symbols
Writing	Service order	Informational report Terminology Clarity of expression

151

(TASK STATEMENT) V-4 CHECK HEAT EXCHANGER

152

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
STK	Locate heat exchanger Inspect heat exchanger Test heat exchanger	Safety Proper care and use of hand tools Hazard Injuries to oneself or others

DECISIONS	CUES	ERRORS
Determine that problem exists in heat exchanger	Customer complains of smelling fumes	Failure to determine that heat exchanger is defective could result in serious injury or possible death to the occupants.

152

(TASK STATEMENT) V-4 CHECK HEAT EXCHANGER

SCIENCE

Simple machines used to gain mechanical advantage
[STK]
Forces acting on a body immersed or floating in a liquid
[Level]

Behavior Science:

Technician should talk only about the repair job and in a knowledgeable way. and promote his employer whenever possible.
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He should be cautioned to enter only into those customer relations which pertain to the job at hand. Personal entanglements or arguments with customers should always be avoided.
Billing and discussion of costs should be accurate, honest and performed in a straight forward manner.
He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

MATH – NUMBER SYSTEMS

Rationals—Fractions

Use of Numbers: (without calculation)
[eyeballing floor area]
Ordering—[S.T.K.]
Coding—[mfg. data plate]
Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Arithmetic Skills and Concepts—Rule of thumb
[approximation]
Basic Geometry Skills and Concepts
Knowledge of geometric relationships—Symmetry
[center point]
Determination of area, perimeter and diagonals of polygons with more than 4 sides.
Basic Arithmetic Skills and Concepts—Property of comparison
Basic Measurement Skills and Concepts
Instruments—[tape]
Measurement: Geometric
Linear
Area
Reading and interpreting tables, charts. and graphs—[capacity chart]

COMMUNICATIONS

PERFORMANCE MODES

Reading

Viewing

Speaking

Writing

EXAMPLES

Instructions

Position of mounting frame

Verbal instructions

Service order

SKILLS/CONCEPTS

Process report

Visual analysis

Terminology/General vocabulary
Clarity of expression

Informational report
Terminology
Clarity of expression

(TASK STATEMENT) V-5 CHECK PILOT AND THERMOCOUPLE ASSEMBLY

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
STK MAVT	Check pilot flame and adjustment Check thermocouple Clean or replace defective components and thermocouple assembly	Safety Proper care and use of hand tools Hazard Injuries to oneself or others

DECISIONS	CUES	ERRORS
Determine if pilot flame out of adjustment or thermocouple is possibly defective Determine type and size of components in assembly according to mfg. specifications	No heat	Failure to clean pilot or replace thermocouple or other components in pilot assembly would result in the problem continuing Parts could be changed unnecessarily or not fit properly

(TASK STATEMENT) V-5 CHECK PILOT AND THERMOCOUPLE ASSEMBLY

SCIENCE

Effect of heating and cooling on expansion of materials
[Bimetal]
Transfer of heat from one body to another
[heat on thermocouple]

Behavior Science:

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
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He should maintain a proper balance between pressure to complete job and pride in work.
Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.
He should be cautioned to enter only into those customer relations which pertain to the job at hand. Personal entanglements or arguments with customers should always be avoided. Billing and discussion of costs should be accurate, honest and performed in a straight forward manner.
He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

MATH – NUMBER SYSTEMS

Rational Numbers:

Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Arithmetic Skills and Concepts
Ratio and proportion—oil
Basic Measurement Skills and Concepts
Instruments
Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.
Basic Logic
Deductive/Inductive

Use of Numbers: (without calculation)
Coding—Mfg. data plate.

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Schematic MAVT	Terminology Wiring diagram Detail inference
Viewing	Components schematic	Visual analysis Logic
Writing	Service order	Informational report Terminology Clarity of expression

151

(TASK STATEMENT) **V-6 CHECK WALL THERMOSTAT**

156

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
STK	Check calibration of thermostat Adjust Replace if necessary Check operation	Safety: Always disconnect circuit and lock out breaker before working on electrical components Care in use of hand tools Hazard: Electrical shock, electrical burn Injury to oneself or others

DECISIONS	CUES	ERRORS
Determine location of wall thermostat Determine type and calibration setting of thermostat according to mfg. specifications	Burnier shots off on high limit No heat Not enough heat	Failure to perform task properly would result in faulty operation of unit

152

(TASK STATEMENT) V-6 CHECK WALL THERMOSTAT

SCIENCE

Simple machines used to gain mechanical advantage [STK]
Effect of heating and cooling on expansion of materials [Bimetal]
Fluids under pressure [Oil]

Behavior Science:

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
He should consult with superiors when difficulty arises.
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He should maintain a proper balance between pressure to complete job and pride in work.
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He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

MATH – NUMBER SYSTEMS

Rational Numbers:

Fundamental Operations (Calculation)
  Addition algorithm
  Subtraction algorithm
Basic Arithmetic Skills and Concepts
  Ratio and proportion—oil
Basic Measurement Skills and Concepts
  Instruments
  Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.
Basic Logic
  Deductive/Inductive

Uses of numbers (without calculation)
  Coding—[Mfg. data plate]

COMMUNICATIONS

PERFORMANCE MODES

Reading

Viewing

Writing

EXAMPLES

Central settings

Central adjustments

Service order

SKILLS/CONCEPTS

Detail inference

Visual analysis

Informational report
Terminology
Clarity of expression

(TASK STATEMENT) V-7 CHECK GAS VALVE ASSEMBLY

158

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
STK VOM	Check valve Remove plunger and clean valve seat Check valve operation	Safety: Always disconnect circuit and lock out breaker before working on electrical components Hazard: Electrical shock—electrical burn
DECISIONS	**CUES**	**ERRORS**
Determine if there is voltage to valve Determine type of valve used	No heat Valve chatters	Failure to make proper decisions would result in changing a part or making improper repair

151

(TASK STATEMENT) V-7 CHECK GAS VALVE ASSEMBLY

SCIENCE

Simple machines used to gain mechanical advantage [STK]
Effect of heating and cooling on expansion of materials [Bimetal]
Fluids under pressure [Oil]
Magnetic fields of force [Solenoid]
Behavior Science:

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
He should consult with superiors when difficulty arises.
He should answer questions which relates to the repair job at hand with honesty and integrity.
He should maintain a proper balance between pressure to complete job and pride in work.
Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.
He should be cautioned to enter only into those customer relations which pertain to the job at hand. Personal entanglements or arguments with customers should always be avoided. Billing and discussion of costs should be accurate, honest and performed in a straight forward manner.
He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

MATH — NUMBER SYSTEMS

Rational Numbers:

Fundamental Operations (Calculation)
  Addition algorithm
  Subtraction algorithm
Basic Arithmetic Skills and Concepts
  Ratio and proportion—oil
Basic Measurement Skills and Concepts
  Instruments
  Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.
Basic Logic
  Deductive/Inductive

Uses of Numbers: (without calculation)
  Coding—Mfg. data plate

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Specifications VOM	Detail inference
Viewing	Components	Visual analysis Logic
Writing	Service order	Informational report Terminology Clarity of expression

(TASK STATEMENT) **V-8 CHECK AND ADJUST FAN CONTROL**

160

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
STK	Locate control Adjust control Check operations	Safety: Proper care and use of hand tools Hazard: Injuries to oneself or others

DECISIONS	CUES	ERRORS
Determine control adjustment settings according to mfg's. specifications	Fan runs continuously Insufficient heat No heat	Improper adjustment would result in continued erratic operation

(TASK STATEMENT) V-8 CHECK AND ADJUST FAN CONTROL

SCIENCE

Simple machines used to gain mechanical advantage
(STK)

Behavior Science:

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
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He should answer questions which relates to the repair job at hand with honesty and integrity.
He should maintain a proper balance between pressure to complete job and pride in work.
Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.
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He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

MATH – NUMBER SYSTEMS

Rational Numbers:

Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Arithmetic Skills and Concepts
Ratio and proportion—oil
Basic Measurement Skills and Concepts
Instruments
Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.
Basic Logic
Deductive/Inductive

Uses of Numbers: (without calculation)
Coding—Mfg. data plate

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Specifications	Detail inference
Viewing	Central adjustments	Visual analysis
Writing	Service order	Informational report Terminology Clarity of expression

(TASK STATEMENT) V-9 CHECK AND ADJUST LIMIT CONTROL

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
STK	Locate control Adjust control Check operations	Safety: Proper care and use of hand tools Hazard: Injuries to oneself or others

DECISIONS	CUES	ERRORS
Determine control adjustment settings according to mfg. specifications	Unit short cycle No heat	Improper adjustment would result in continued erratic operations

(TASK STATEMENT) V-9 CHECK AND ADJUST LIMIT CONTROL

SCIENCE

Simple machines used to gain mechanical advantage
[STK]
Effective heating and cooling on expansion of materials

MATH – NUMBER SYSTEMS

Rational Numbers:

Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Arithmetic Skills and Concepts
Ratio and proportion—oil
Basic Measurement Skills and Concepts
Instruments
Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.
Basic Logic
Deductive/Inductive

Uses of Numbers: (without calculation)
Coding—Mfg. data plate

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Specifications	Detail inference
Viewing	Central adjustments	Visual analysis
Writing	Service order	Informational report Terminology Clarity of expression

(TASK STATEMENT) **V-10 CHECK AND ADJUST OIL BURNER**

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
STK DG $C0_2$ K SGA	Check pump pressure Check nozzle size Check stack temperature Obtain CO_2 reading Obtain smoke density reading Obtain over five draft readings	Safety: Proper care and use of hand tools Use care when working with oil Hazard: Injury to oneself or others may occur Fire or explosion may occur

DECISIONS	CUES	ERRORS
Determine proper fining rate Determine proper draft and over fire in pipe Determine according to mfg's. specifications	Maintenance check Use too much fuel Smoke odor Insufficient heat	Failure to check and accurately adjust burner would cause unit to operate inefficiently

(TASK STATEMENT) V-10 CHECK AND ADJUST OIL BURNER

SCIENCE

Simple machines used to gain mechanical advantage [SAK]
Effect of heating and cooling on expansion of
materials [Bimetal]
Fluids under pressure [Oil]

Transfer of heat from one body to another
[oil]

Behavior Science:

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
He should consult with superiors when difficulty arises.
He should answer questions which relates to the repair job at hand with honesty and integrity.
He should maintain a proper ba ance between pressure to complete job and pride in work.
Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.
He should be cautioned to enter only into those customer relations which pertain to the job at hand. Personal entanglements or arguments with customers should always be avoided.
Billing and discussion of costs should be accurate, honest and performed in a straight forward manner.
He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

MATH – NUMBER SYSTEMS

Rational Numbers:

Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Arithmetic Skills and Concepts
Ratio and proportion—oil
Basic Measurements Skills and Concepts
Instruments—[DG, CO_2K, DST, SGA]
Given an instrument of measure, determine precision and or accuracy with respect to relative error, significant digits, and tolerance
[DG, CO_2K, DST, SGA]

Uses of Numbers: (without calculation)
Coding—[Mfg. data plate]
Basic Arithmetic Skills and Concepts
Ratio and proportion [oil]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Specifications Instruments	Detail inference
Viewing	Components Instruments	Visual analysis Logic
Writing	Service order	Informational report Terminology Clarity of expression

165

(TASK STATEMENT) V-11 CHECK NATURAL GAS MANIFOLD PRESSURE

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Standard Tool Kit Manometer	Connect manometer to manifold Take reading of the manometer Compare reading of manometer and gas meter dial to mfg B T U rating. Adjust regulator accordingly	Safety. Make sure area is clear and metering device securely mounted away from fire and hands away from flame Hazard Improper adjustment can cause back flash when burner lites or is extinguished

DECISIONS	CUES	ERRORS
Remove plug from manifold and connect manometer	Improper fire in unit causing loss of B T.U input and insufficient operation	Regulator set too high will cause overfiring and burn out heat exchanger

ASK STATEMENT) V-11 CHECK NATURAL GAS MANIFOLD PRESSURE

SCIENCE	MATH – NUMBER SYSTEMS
Work input, work output, friction and efficiency in simple machines	Ratio and Proportion

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Instructions	Process report
Writing	Service order	Informational report Terminology Clarity of expression

Duty VI Servicing and Repairing Warm Air Heating Systems

1 Replace heat exchanger
2 Remove and replace oil pump
3 Remove and replace cad cell
4 Remove and replace oil nozzle
5 Remove and replace electrodes
6 Remove and replace limit control
7 Remove and replace fan control
8 Remove and replace gas valve
9 Remove and replace wall thermostat
10 Remove and replace pilot safety
11 Replace blower motor shaft and bearings
12 Replace belt drive blower motor
13 Replace direct drive blower motor

168

TASK STATEMENT) **VI-1 REPLACE HEAT EXCHANGER**

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
STK	Locate heat exchanger Remove heat exchanger Replace heat exchanger Check unit operations	Safety: Care and proper use of hand tools Use care when working with gas, oil, or electricity Hazard: Injury to oneself or others may occur Fire or explosion may occur

DECISIONS	CUES	ERRORS
Determine proper replacement according to mfg's. model and serial nos.	Crack or hole found in heat exchanger	Failure to install proper heat exchanger could result in unit not functioning properly and inefficiently

169

(TASK STATEMENT) VI-1 REPLACE HEAT EXCHANGER

SCIENCE

Simple machines used to gain mechanical advantage
[STK]
Transfer of heat from one body to another
[Expansion and contraction of chamber]
Relationship of force to distortion in an elastic body
[Expansion and contraction of chamber]

Behavior Science:

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
He should consult with superiors when difficulty arises.
He should answer questions which relates to the repair job at hand with honesty and integrity.
He should maintain a proper balance between pressure to complete job and pride in work.
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He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

MATH – NUMBER SYSTEMS

Rational Numbers:

Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Arithmetic Skills and Concepts
Ratio and proportion—oil
Basic Measurement Skills and Concepts
Instruments
Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.
Basic Logic
Deductive/Inductive

Uses of Numbers: (without calculation)
Coding—[Mfg. data plate]
Basic Geometry Skills and Concepts
Knowledge of geometric relationships
[Duct]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Data plate Mfg. instructions	Detail inference
Viewing	Components	Visual analysis
Writing	Service order	Informational report Terminology/General vocabulary Clarity of expression

TASK STATEMENT) **VI-2 REMOVE AND REPLACE OIL PUMP**

TOOLS, EQUIPMENT MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
STK	Turn off oil supply Remove pump Replace pump Check operation	Safety: Care and proper use of hand tools Use care when working with gas, oil, or electricity Hazard: Injury to oneself or others may occur Fire or explosion may occur

DECISIONS	CUES	ERRORS
Determine replacement according to mfg's. model and serial Nos.	No suction of pump Leak in pump	Failure to make proper replacement could result in improper unit operation

(TASK STATEMENT) VI-2 REMOVE AND REPLACE OIL PUMP

SCIENCE

Simple machines used to gain mechanical advantage [STK]
Effect of heating and cooling on expansion of materials [Bimetal]
Fluids under pressure [Oil]

Behavior Science:

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
He should consult with superiors when difficulty arises.
He should answer questions which relates to the repair job at hand with honesty and integrity.
He should maintain a proper balance between pressure to complete job and pride in work.
Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.
He should be cautioned to enter only into those customer relations which pertain to the job at hand. Personal entanglements or arguments with customers should always be avoided. Billing and discussion of costs should be accurate, honest and performed in a straight forward manner.
He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

MATH – NUMBER SYSTEMS

Rational Numbers:

Fundamental Operations (Calculations)
Addition algorithm
Subtraction algorithm
Uses of Numbers: (without calculation)
Coding—Mfg. data plate
Basic Arithmetic Skills and Concepts
Ratio and proportion
[oil]

COMMUNIC. TIONS

PERFORMANCE MODES

Reading

Viewing

Writing

EXAMPLES

Data plate
Mfg. instructions

Components

Service order

SKILLS/CONCEPTS

Detail inference

Visual analysis

Informational report
Terminology/General vocabulary
Clarity of expression

(TASK STATEMENT) **VI 3 REMOVE AND REPLACE CAD CELL**

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
STK VOM	Disconnect power supply Locate cad cell Remove cad cell Replace cad cell Check operation	Safety: Care and proper use of hand tools Use care in checking power supply Hazard: Injury to oneself or others may occur Severe electrical shock may occur

DECISIONS	CUES	ERRORS
Determine replacement according to mfg's. model and serial Nos.	Cad cell shows open or no resistance	Failure to make correct replacement could result in improper unit operation

(TASK STATEMENT) VI-3 REMOVE AND REPLACE CAD CELL

SCIENCE

Simple machines used to gain mechanical advantage
[STK]
Effects of heating and cooling on expansion of materials
[Bimetal]

Behavior Science:

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
He should consult with superiors when difficulty arises.
He should answer questions which relates to the repair job at hand with honesty and integrity.
He should maintain a proper balance between pressure to complete job and pride in work.
Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.
He should be cautioned to enter only into those customer relations which pertain to the job at hand. Personal entanglements or arguments with customers should always be avoided. Billing and discussion of costs should be accurate, honest and performed in a straight forward manner.
He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

MATH – NUMBER SYSTEMS

Rational Numbers:

Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Arithmetic Skills and Concepts
Ratio and proportion—oil
Basic Measurement Skills and Concepts
Instruments
Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.
Basic Logic
Deductive/Inductive

Uses of Numbers: (without calculation)
Coding—Mfg. data plate

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Data plate Mfg. instructions	Detail inference
Viewing	Components	Visual analysis
Writing	Service order	Informational report Terminology/General vocabulary Clarity of expression

TASK STATEMENT) **VI-4 REMOVE AND REPLACE OIL NOZZLE**

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
STK	Locate nozzle Remove nozzle Replace nozzle Check operation	Safety: Care and proper use of hand tools Use care when working with oil Hazard: Injury to oneself or others may occur Fire or explosion may occur

DECISIONS	CUES	ERRORS
Determine correct nozzle replacement according to mfg's. model and serial Nos.	No heat Nozzle plugged	Failure to make correct replacement could result in improper unit operation

(ASK STATEMENT) VI-4 REMOVE AND REPLACE OIL NOZZLE

SCIENCE

Simple machines used to gain mechanical advantage [STK]
Effect of heating and cooling on expansion of materials [Bimetal]
Fluids under pressure [Oil]

Behavior Science:

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
He should consult with superiors when difficulty arises.
He should answer questions which relates to the repair job at hand with honesty and integrity.
He should maintain a proper balance between pressure to complete job and pride in work.
Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.
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He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

MATH – NUMBER SYSTEMS

Rational Numbers:

Fundamental Operations (Calculation)
- Addition algorithm
- Subtraction algorithm

Basic Arithmetic Skills and Concepts
- Ratio and proportion—oil

Basic Measurement Skills and Concepts
- Instruments
- Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.

Basic Logic
- Deductive/Inductive

Uses of Numbers: (without calculation)
- Coding—Mfg. data plate

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Data plate Mfg. instructions	Detail inference
Viewing	Components	Visual analysis
Writing	Service order	Informational report Terminology/General vocabulary Clarity of expression

(TASK STATEMENT) **VI-5 REMOVE AND REPLACE ELECTRODES**

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
STK	Locate electrodes Remove electrodes Replace electrodes Make proper adjustments Check operation	Safety: Proper care and use of hand tools Use care in checking power wupply Hazard: Injury to oneself or others may occur Severe electrical shock may occur

DECISIONS	CUES	ERRORS
Determine if electrodes are defective	No heat No spark	Failure to make proper replacement could result in improper unit operation

(TASK STATEMENT) VI-5 REMOVE AND REPLACE ELECTRODES

SCIENCE

Simple machines used to gain mechanical advantage [STK]
Effect of heating and cooling on expansion of materials [Bimetal]

Behavior Science:

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
He should consult with superiors when difficulty arises.
He should answer questions which relates to the repair job at hand with honesty and integrity.
He should maintain a proper balance between pressure to complete job and pride in work.
Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.
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He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

MATH – NUMBER SYSTEMS

Rational Numbers:

Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Arithmetic Skills and Concepts
Ratio and proportion—oil
Basic Measurement Skills and Concepts
Instruments
Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.
Basic Logic
Deductive/Inductive
Uses of Numbers: (without calculation)
Coding—Mfg. data plate

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Data plate Mfg. instructions	Detail inference
Viewing	Components	Visual analysis
Writing	Service order	Informational report Terminology/General vocabulary Clarity of expression

(TASK STATEMENT) **VI-6 REMOVE AND REPLACE LIMIT CONTROL**

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
STK	Disconnect power supply Remove control Install new control and adjust Check operation	Safety: Disconnect power supply Proper care and use of hand tools Hazard: Electrical shock or burn may occur Injury to oneself or others may occur

DECISIONS	CUES	ERRORS
Determine type of control according to mfg's. model and serial Nos.	Control defective	Failure to make proper replacement and adjustments would result in inefficient operation of the unit

(TASK STATEMENT) VI-6 REMOVE AND REPLACE LIMIT CONTROL

SCIENCE

Simple machines used to gain mechanical advantage [SFK]
Effect of heating and cooling on expansion of materials [Bimetal]

Behavior Science:

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
He should consult with superiors when difficulty arises.
He should answer questions which relates to the repair job at hand with honesty and integrity.
He should maintain a proper balance between pressure to complete job and pride in work.
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He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

MATH – NUMBER SYSTEMS

Rational Numbers:

Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Arithmetic Skills and Concepts
Ratio and proportion—oil
Basic Measurement Skills and Concepts
Instruments
Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.
Basic Logic
Deductive/Inductive

Uses of Numbers: (without calculations)
Coding—Mfg. data plate

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Data plate Mfg. instructions	Detail inference
Viewing	Components	Visual analysis
Writing	Service order	Informational report Terminology/General vocabulary Clarity of expression

TASK STATEMENT) **VI-7 REMOVE AND REPLACE FAN CONTROL**

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
STK	Disconnect power supply Remove control Replace new control and adjust Check operation	Safety: Disconnect power supply Proper care and use of h.nd tools Hazard: Electrical shock or burn may occur Injury to oneself or others may occur

DECISIONS	CUES	ERRORS
Determine type of control according to mfg's. model and serial Nos.	Control defective	Failure to make proper replacement and adjustment would result in inefficient operation of the unit

(TASK STATEMENT) VI-7 REMOVE AND REPLACE FAN CONTROL

SCIENCE

Simple machines used to gain mechanical advantage [STK]
Effect of heating and cooling on expansion of materials [Bimetal]

Behavior Science:

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
He should consult with superiors when difficulty arises.
He should answer questions which relates to the repair job at hand with honesty and integrity.
He should maintain a proper balance between pressure to complete job and pride in work.
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He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

MATH – NUMBER SYSTEMS

Rational Numbers:

Fundamental Operations (Calculation)
- Addition algorithm
- Subtraction algorithm

Basic Arithmetic Skills and Concepts
- Ratio and proportion– oil

Basic Measurement Skills and Concepts
- Instruments
- Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.

Basic Logic
- Deductive/Inductive

Uses of Numbers: (without calculation)
- Coding—Mfg. data plate

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Data plate Mfg. instructions	Detail inference
Viewing	Components	Visual analysis
Writing	Service order	Informational report Terminology/General vocabulary Clarity of expression

(TASK STATEMENT) **VI-8 REMOVE AND REPLACE GAS VALVE**

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
STK	Turn off fuel supply Remove valve Replace valve Check valve operation	Safety: Care and proper use of hand tools Use care when working with gas Hazard: Injury to oneself or others may occur Fire or explosion may occur

DECISIONS	CUES	ERRORS
Determine type of valve and proper replacement according to mfg's. specifications	Gas valve defective	Failure to make proper replacement would result in unit not functioning properly

(TASK STATEMENT) VI-8 REMOVE AND REPLACE GAS VALVE

SCIENCE

Simple machines used to gain mechanical advantage [STK]
Effect of heating and cooling on expansion o
materials [Bimetal]
Magnetic fields of force
[solenoids]
Fluids under pressure
[gas]

Behavior Science:

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
He should consult with superiors when difficulty arises
He should answer questions whic! relates to the repair job at hand with honesty and integrity.
He should maintain a proper balance between pressure to complete job and pride in work.
Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.
He should be cautioned to enter only into those customer relations which pertain to the job at hand. Personal entanglements or arguments with customers should always be avoided. Billing and discussion of costs should be accurate, honest and performed in a straight forward manner.
He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

MATH – NUMBER SYSTEMS

Rational Numbers:

Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Arithmetic Skills and Concepts
Ratio and proportion—oil
Basic Measurement Skills and Concepts
Instruments
Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.
Basic Logic
Deductive/Inductive
Uses of Numbers: (without calculation)
Coding—Mfg. data plate

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Data plate Mfg. instructions	Detail inference
Viewing	Components	Visual analysis
Writing	Service order	Informational report Terminology/General vocabulary Clarity of expression

(TASK STATEMENT) **VI-9 REMOVE AND REPLACE WALL THERMOSTAT**

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY -- HAZARD
STK	Remove thermostat Replace thermostat and check calibration Check operation	Safety: Proper care and use of hand tools Hazard: Injury to oneself or others may occur

DECISIONS	CUES	ERRORS
Determine type and/or replacement thermostat according to mfg's. model and serial Nos.	Thermostat cannot be calibrated or adjusted	Failure to replace with proper thermostat would result in unit not performing to its capacity

(ASK STATEMENT) VI-9 REMOVE AND REPLACE WALL THERMOSTAT

SCIENCE

Simple machines used to gain mechanical advantage [STK]
Effect of heating and cooling on expansion of
materials [Bimetal]
Transfer of heat from one body to another
[Heat on bimetal]

Behavior Science:

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
He should consult with superiors when difficulty arises.
He should answer questions which relates to the repair job at hand with honesty and integrity.
He should maintain a proper balance between pressure to complete job and pride in work.
Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.
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He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

MATH – NUMBER SYSTEMS

Rational Numbers:

Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Basic Arithmetic Skills and Concepts
Ratio and proportion—oil
Basic Measurement Skills and Concepts
Instruments
Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.
Basic Logic
Deductive/Inductive
Uses of Numbers: (without calculation)
Coding-Mfg. data plate
Basic Measurement Skills and Concepts
Reading and interpreting representational graphs
[Wiring diagram]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Data plate Mfg. instructions	Detail inference
Viewing	Components	Visual analysis
Writing	Service order	Informational report Terminology/General vocabulary Clarity of expression

(TASK STATEMENT) **VI-10 REMOVE AND REPLACE PILOT SAFETY**

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
STK	Turn off fuel supply Locate defective component Replace defective component Check for proper operation	Safety: Proper care and use of hand tools Use care when working with gas Hazard: Injury to oneself or others may occur Fire or explosion may occur

DECISIONS	CUES	ERRORS
Determine what component in safety pilot assembly is defective Determine type and size or proper replacement according to mfg's. model and serial Nos.	No heat Customer must relight pilot or reset safety button	Failure to replace proper component would result in complaint not being satisfied or continued erratic operation of the unit

(TASK STATEMENT) VI-10 REMOVE AND REPLACE PILOT SAFETY

SCIENCE

Simple machines used to gain mechanical advantage [STK]
Effect of heating and cooling on expansion of
materials [Bimetal]
Fluids under pressure [gas]

Behavior Science:

Technician should talk only about the repair job and in a knowledgeable way, and promote his employer whenever possible.
He should consult with superiors when difficulty arises.
He should answer questions which relates to the repair job at hand with honesty and integrity.
He should maintain a proper balance between pressure to complete job and pride in work
Emphasis should be placed upon performing the task at hand without unnecessarily disrupting surrounding activities and he should show concern for the premises.
He should be cautioned to enter only into those customer relations which pertain to the job at hand. Personal entanglements or arguments with customers should always be avoided. Billing and discussion of costs should be accurate, honest and performed in a straight forward manner.
He should get along with his fellow employee and develop a relationship that will not hurt each others professionalism.

MATH – NUMBER SYSTEMS

Fundamental Operations (Calculation)
Addition algorithm
Subtraction algorithm
Uses of Numbers: (Without calculation)
Coding—Mfg. data plate
Basic Arithmetic Skills and Concepts
Ratio and proportion—Gas

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Data plate Mfg. instructions	Detail inference
Viewing	Components	Visual analysis
Writing	Service order	Informational report Terminology/General vocabulary Clarity of expression

(TASK STATEMENT) **VI-11 REPLACE BLOWER MOTOR SHAFT AND BEARINGS**

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Standard Tool Kit Set blower bearings Blower shaft	Disconnect blower from unit Replace shaft and bearings in blower Reassemble blower in unit Check rotation of blower to observe proper clearance	Safety Be sure cabinet or remaining parts are supported properly when repairing section is removed Hazard: When disconnecting blower unit it can drop thus denting housing making it inoperable after repair
DECISIONS	**CUES**	**ERRORS**
To replace bearings only or complete shaft and bearing unit	Noisy operation of blower unit	Improper location of shaft stops can cause enough friction to cause overloading of blower motor

TASK STATEMENT: VI-11 REPLACE BLOWER MOTOR SHAFT AND BEARINGS

SCIENCE

Work input and work output, friction and efficiency in simple machines

MATH – NUMBER SYSTEMS

Rational Numbers:

Fundamental Operations (Calculation)
- Addition algorithm
- Subtraction algorithm

Basic Arithmetic Skills and Concepts
- Ratio and proportion—oil

Basic Measurement Skills and Concepts
- Instruments
- Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance

Basic Logic
- Deductive/Inductive

Uses of Numbers: (without calculation)
- Coding—Mfg. data plate

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Instructions	Process report
Writing	Service order	Informational report Terminology Clarity of expression

(TASK STATEMENT) VI-12 REPLACE BELT DRIVE BLOWER MOTOR

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Standard Tool Kit Rubber Mount Motor V-Belt Amprobe	Disconnect blower supply Remove motor and replace Rewire motor Install V-Belt—allign and correct tension Check unit motor amp draw against motor rating	Safety Cover ends of disconnected wires Hazard: Motor can be dropped causing injury to the workers feet or fingers due to the position while performing the task

DECISIONS	CUES	ERRORS
Proper H P motor	Inoperative blower	Improper wire connections motor runs wrong direction

(TASK STATEMENT) VI-12 REPLACE BELT DRIVE BLOWER MOTOR

SCIENCE

Work input, work output, friction and efficiency in simple machines

MATH – NUMBER SYSTEMS

Rational Numbers:

Fundamental Operations (Calculation)
- Addition algorithm
- Subtraction algorithm

Basic Arithmetic Skills and Concepts
- Ratio and proportion—oil

Basic Measurement Skills and Concepts
- Instruments
- Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.

Basic Logic
- Deductive/Inductive

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Instructions	Process report
Writing	Service order	Informational report Terminology Clarity of expression

(TASK STATEMENT) VI-13 REPLACE DIRECT DRIVE BLOWER MOTOR

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON

Standard Tool Kit
Direct Drive Motor

PERFORMANCE KNOWLEDGE

Disconnect power supply
Remove complete blower assembly
Remove motor from Moontina Brackets and reinstall with previous H.P. and R.P.M. rated motor
Check operation

SAFETY – HAZARD

Safety:

Lifting in an unnatural position can cause back injury

Hazard:

Keep hands free from blower compartment during the checking operation—can cause cuts, bruises and other injuries

DECISIONS

Accessability to the blower compartment

CUES

Bent shaft on old motor

ERRORS

Make wrong wiring connections

Rotation of motor

(TASK STATEMENT) VI-13 REPLACE DIRECT DRIVE BLOWER MOTOR

SCIENCE

Work input, work output, friction and efficiency.

MATH – NUMBER SYSTEMS

Rational Numbers:

Fundamental Operations (Calculation)
- Addition algorithm
- Subtraction algorithm

Basic Arithmetic Skills and Concepts
- Ratio and proportion—oil

Basic Measurement Skills and Concepts
- Instruments
- Given an Instrument of Measure, determine precision and/or accuracy with respect to relative error, significant digits, and tolerance.

Basic Logic
- Deductive/Inductive

Uses of Numbers: (without calculation)
- Coding—Mfg. data plate

COMMUNICATIONS

PERFORMANCE MODES

Reading

Writing

EXAMPLES

Instructions

Service order

SKILLS/CONCEPTS

Process report

Informational report
Terminology
Clarity of expression

Index: Standard Tool Kit

STK—Standard Tool Kit

1-Wire Brush
1-Scratch Awl
1-Needle Nose Pliers
1-Standard Screwdriver Set 12", 6", 4", Stubby, and Pocket Size
1-Allen Wrench Set
1-Phillips Screwdriver Set 8", 4", and Stubby
1-Set Open Adjustable Wrenches 12", 10", 8", 6", 4"
1-Channel Lock Pliers
1-Standard Pliers
1-Socket Set ⅛'' to ¾''
1-Nut Driver Set ⅛'' to ½''
1-Vaco Grip Pliers
1-Spark Drill
1-Swage Kit 3/16" to 1/2"
1-Set Orifice Drills
1-Level
1-Set Box End Wrenches
1-Set Open End Wrenches
1-Tube Cutter
1-Mini Tube Cutter
1-Flaring Tool Kit
1-Valve Wrench
1-Magnet
1-Hand Drill
1-Nozzle Wrench
1-Inspection Mirror
2-Spirit Thermometers
1-Flashlight
2-Pipe Wrenches 14", 10"
1-Crimper Tool
1-Hand Brake Tool
1-Rule or Tape
1-Pair Double Cut Snips
1-50' Grounded Extension Cord
1-Oil Can
1-⅜ Electric Drill
1-Set Drill Bits
1-Star Drill
2-Chisels 12" long and 1 cold
2-Hammers medium, large
1-Sheet Metal Hammer
1-Pair Straight Snips 3" jaw
1-Pair Left Snips
1-Pair Right Snips
1-Pair Goggles
1-Hack Saw
Silver Clips
1-Hard Hat or Plastic Bump Hat

Index: Test Equipment

TEST EQUIPMENT

AP	AMPROBE
AVI	AIR VELOCITY INDICATOR
AVM	AIR VELOCITY METER
CA	CAPACITOR ANALYZER
CO_2K	CO_2 KIT
CTK	COMBUSTION TEST KIT
DC	DIAL A CHARGE
DG	DRAFT GAUGE
DST	DIAL STACK THERMOMETER
ELD	ELECTRONIC LEAK DETECTOR
HLD	HALIDE LEAK DETECTOR
MAVT	MILLI AMP VOLT TESTER
MG	MANIFOLD AND GAUGES
PT	PRESTOLITE B TANK WITH TORCH HEAD
SGA	SMOKE GAUGE ANALYZER
SP	SLING PSYCHROMETER
TPT	TAYLOR PLENUM THERMOMETER
TT	THERMISTER THERMOMETER
UM	MANOMETER
VG	VACUUM GAUGE
VOM	VOLT OHM METER
VP	VACUUM PUMP
WM	WATT METER

SS STANDARD SUPPLIES

1. PIPE JOINT COMPOUND
2. LEAK LOCK
3. SILVER SOLDER
4. SILVER SOLDER FLUX
5. COPPER TUBING
7. COPPER SWEAT FITTINGS
8. PIPE FITTINGS
9. GAS COCKS
10. REFRIGERATION VALVES
11. SEALING COMPOUND
12. DRIERS
13. SIGHT GLASSES
14. MOISTURE INDICATORS
15. CYLINDER R-12
16. CYLINDER R-22
17. CYLINDER NITROGEN
18. REFRIGERATION OIL
19. IN LINE SERVICE VALVES
20. CAPACITORS
21. OVERLOAD PROTECTORS
22. RELAYS
23. BELTS
24. FILTERS
25. TAPE: ELECTRICIANS, FURNACE, ARMAFLEX, FRICTION
26. ASSORTED WIRE NUTS, SHEET METAL SCREWS, NUTS, BOLTS

APPENDIX

	Domestic Refrigeration	Commercial Refrigeration	Air Conditioning	Heating
Duty I				
1. Install Window Air Conditioner	x		x	
2. Install Central Air Conditioner			x	
3. Install Self Contained Commercial Refrigeration Unit		x		
4. Install Remote Condensing Unit with Single Cabinet		x		
5. Install Remote Commercial Condensing Unit with Multiple Cabinets		x		
Duty II				
1. Hook Hermetic Compressor Direct to Power Supply	x	x	x	
2. Check Circuitry of the Compressor, Protector and Relay	x	x	x	
3. Check Capacitor	x	x	x	
4. Check Circuitry of Defrost System	x	x	x	
5. Check Circulation Fan Motors	x	x	x	
6. Check and Adjust Control Thermostat	x	x	x	
7. Attach Manifold and Gauges to Service Valves and Check Pressure	x	x	x	
9. Check Compressor Efficiency	x	x	x	
10. Locate Leak in a Refrigeration System Using Electronic Leak Detector	x	x	x	
11. Locate Leak in a Refrigeration System Using Halide Torch	x	x	x	
12. Locate Leak in a Refrigeration System Using Bubble Method	x	x	x	
13. Check Unit Operation—Oil Level—Sight Glass—Moisture Indicator		x	x	
14. Check and Adjust Automatic Expansion Valve		x	x	
15. Check, Test, and Adjust Thermostatic Expansion Valve		x	x	
16. Check and Adjust Pressure Motor Control		x	x	
17. Check and Adjust Low Pressure Safety Control		x	x	
18. Check and Adjust High Pressure Safety Control		x	x	
19. Adjust and Calibrate Oil Pressure Control		x	x	
20. Check Icemaker for Operation	x			
21. Check and Adjust Water Valve		x	x	
22. Check Hot Gas Defrost Solenoid and Valve	x	x		

	Refrigeration	Refrigeration	Conditioning	Heating
23. Check Humidity with Sling Psychrometer			x	
24. Check and Adjust Humidstat	x		x	
25. Check Condensate Pump and Drain		x	x	
26. Check Blower Assembly and Filter			x	x
27. Check Heat Pump Reversing System			x	
28. Check System for Burn Out and Install Cleanup Kit	x	x	x	
29. Service Electronic Air Cleaner			x	x

Duty III

1. Evacuate a Refrigeration System	x	x	x	
2. Pump System Down into Receiver Tank		x	x	
3. Recharge System Using Sight Glass		x	x	
4. Recharge System Weighing in Refrigeration		x	x	
5. Fill Dial a Charge	x			
6. Recharge a Refrigeration System Using Dial a Charge	x			
7. Remove and Replace Control Thermostat	x	x	x	
8. Remove and Replace Defrost Timer	x	x		
9. Remove and Replace Motor Overload Protector	x	x	x	
10. Remove and Replace Capacitor	x	x	x	
11. Remove and Replace Defrost Heater	x	x		
12. Remove and Replace Defrost Terminator	x	x		
13. Remove and Replace Relay	x	x	x	
14. Remove and Replace Fan Motors	x	x	x	x
15. Repair Leak in Copper Lines of System	x	x	x	
16. Remove and Replace Compressor	x	x	x	
17. Add Oil to System	x	x	x	
18. Remove Restriction from Capillary Tube	x	x	x	
19. Remove and Replace Capillary Tube	x	x	x	
20. Remove and Replace Automatic Expansion Valve		x	x	
21. Remove and Replace Thermostatic Expansion Valve		x	x	
22. Install a Drier, Sight Glass or Moisture Indicator		x	x	
23. Remove and Replace High or Low Pressure Safety Control		x	x	
24. Remove and Replace High or Low Pressure Motor Control		x	x	
25. Remove and Replace Oil Pressure Safety Control		x	x	
26. Remove and Replace Hot Gas Defrost Solenoid and Valve		x		
27. Repair Evaporator with Epoxy	x			
28. Remove and Replace Condensation Pump Motor		x	x	
29. Remove and Replace Humidistat	x		x	
30. Balance the Air Conditioning System			x	x

	Domestic Refrigeration	Commercial Refrigeration	Air Conditioning	Heating
Duty IV				
1. Install Furnaces Gas—Oil—Electric				X
Duty V				
1. Check Oil Supply				X
2. Check Oil Pump				X
3. Check Ignition System				X
5. Check Pilot and Thermocouple Assembly				X
6. Check Gas Valve Assembly				X
7. Check Wall Thermostat			X	X
8. Check and Adjust Fan Control			X	X
9. Check and Adjust Limit Control			X	X
10. Check and Adjust Oil Burner				X
11. Check Natural Gas Manifold Pressure			X	X
Duty VI				
1. Replace Heat Exchanger				X
2. Remove and Replace Oil Pump				X
3. Remove and Replace Cad Cell				X
4. Remove and Replace Oil Nozzle				X
5. Remove and Replace Electrodes				X
6. Remove and Replace Limit Control			X	X
7. Remove and Replace Fan Control			X	X
8. Remove and Replace Gas Valve				X
9. Remove and Replace Wall Thermostat			X	X
10. Remove and Replace Pilot Safety				X
11. Replace Blower Motor Shaft and Bearings			X	X
12. Replace Belt Drive Blower Motor			X	X
13. Replace Direct Drive Blower Motor			X	X